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Paper Title/Authors Detail	Page No:
Effect of Dolomite Powder on SCC as a Filler Material Gopalsamy.A, Shahul Hameed.M	1-5
Study on Microstructure and Strength Parameters of Self Compacting Concrete Using Crimped Steel Fibres Varunan.J, Kumar.P	6-10
Mechanical Properties of Self Compacting Concrete by using 20mm Coarse Aggregates and without Super Plasticizer Ravichandran Subbarayalu, Kalai Selvi. P, Vasumathi A M, Logaraja R	11-17
Experimental Study on Durability of Self- Compacting Concrete Using Steel Fiber P.Eanesto, P.Kumar	18-21
Experimental Study on Embankment Slope Protection using Plastic Waste, Marble Sludge and Crusher Dust P.Alagudurai, R.Santhanamari, K.DuraiKoothan, M.Kumar@Vennimalai, R.Priyadharshini	22-25
Experimental Study on Flexural Behaviour of Steel Beam at Diverse Loading M.Abinaya, J.Dharani, P.Kothai, S.Dharmar	26-29
Experimental Investigation on Flexural Behavior of RCC Beams Retrofitted with Coir and Glass FRP Sheets Nishanth.M, Banupriya.R	30-33
New Algorithm Development for Sleeve Synchronizer Gear Hobbing Process Parameter Optimization S.Rajarasalnath[1], Dr. K. Balasubramanian[2], Dr. N.Rajeswari[3]	34-37
Study on High Volume Fly Ash Concrete Incorporating Fumed Silica as an Admixture R.Sashi Booshan, Dr. B.G.Vishnuram	38-41
Workers' opinion towards participation in management among Spinning Mills, Rajapalayam Kasi Raman. R, Geetharani. K, Sivasankari. B	42-50
Employees' Absenteeism and Effectiveness of Retention Strategies in Sri Jeyajothi Textile Mills (P) Ltd., Rajapalayam. R. Thirumalai Kumar, S.Umamaheswari, M. Priyanka	51-58

Experimental Investigation of CCA Replaced Cement with Glass Fibers 59-65
M.Subahar, R.Veera Venkateswaran

Concept of PMO: A Holistic View 66-70
Christophershyam, Sankar, Srividhya

Experimental Study on Mechanical Behavior of Recycled Aggregate Concrete 71-74
Aloys Amali.S, Andal.T, Jayasurya.J, Jeya Preethi.G, Dr.C.Puthiya Sekar,
P.S.Naufal Rizwan

Study on Mechanical Properties of Self Compacting Concrete using various proportions of Fly Ash 75-79
Bala Dhanesh kumar.S, Karthik Kumar.S, Karuppasamy.S, John Britto.M, Kumar.P

Characteristics Strength of Groundnut Shell Ash (GSA) and Ordinary Portland cement (OPC) Blended Concrete with Stream Curing 80-85
M.Esaki Muthu

Futuristic Contemplate on Hybrid Fibre Self Compacting Concrete 86-90
S.Saranya, Dr. M.Shahul Hameed

A Novel Optimization of Friction Stir Welding Process Parameters on Aluminum Alloy 6061-T6 91-97
Pitchipoo P, Gomathisankar M, Ragavan R, Rajakarunakaran S

Experimental Study on Structural Behaviour of Light Weight Concrete Using LECA 98-102
B.Muthumari, R.Banupriya, S.Arul Mary

An Experimental study on the Bearing Capacity of Model Footing Resting on Sand and Clay Deposit Reinforced with Geogrid 103-109
Muthuselvam

Soil Stabilization using Marble Sludge Powder 110-112
C.Parthiban, Dr.M.Shahulhameed

Evaluation of Carbonation in Concrete using FUZZY Logic 113-119
S.P.Murali Kannan, A.Poonkuzhali

State of Art Report on Self Healing Concrete 120-125
Dr.R.Lakshmi, C.Pracilla

Durability Study on Fly Ash GGBS Based Geopolymer Concrete by Ambient Curing 126-132
Karthik.A, Prasanna.A

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Study on High Volume Fly Ash Concrete Incorporating Fumed Silica as an Admixture

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Abstract: Concrete is the most consumed artificial building material in the world. Unfortunately, due to the manufacture of cement, leads to production large amount of CO_2 emission. From the past studies replacement of cement by fly ash, an industrial waste product offers a sustainable alternative for environmental impact. The present study deals with the mechanical properties of M60 grade concrete. Our work deal with the effect of variation of the cement is replaced by high-volume fly ash and fumed silica. Mix proportion of concrete at the levels of 60% for fly ash and 5%, 10%, and 15% of fumed silica is replaced by weight of cement. Five mixtures with various percentages of fly ash and fumed silica were cast to study their performance for partial alternative to cement. Tests were performed on hardened concrete to determine mechanical strength properties. While replacing high volume fly ash up to 60% concrete takes a prolonged time to attain target strength. The rate of increase in strength by replacing 5% of fumed silica to the above mix, at the same time when the replacement level of fumed silica is increased above 5% less development in rate of increase in strength.

Keywords: Fly Ash, Fumed Silica, Compressive Strength, Split Tensile Strength, Super Plasticizer.

1. Introduction

Portland cement, as an ingredient in concrete, is one of the widely used construction materials, especially in developing countries. The CO_2 emission during its production and the utilization of natural resources are important issues for the construction industry to participate in sustainable development. These limitations led to the search for alternative binders or cement substitutes. Approximately 100 million tones of fly ash are produced in India annually and this is increasing rapidly due to the growth in demand for energy. Unused fly ash in large quantities leads to environmental issues and its storage will be expensive. Fly ash improves the quality and durability of concrete, leading to the increased service life of concrete structures. The HVFA concrete is more suitable for warm weathers and where early strength is not essential.

Concretes having large amounts of fly ash (usually above 50% v/v) are termed as high-volume fly ash (HVFA) concrete. Due to the slow strength development of fly ash concrete caused by the slow pozzolanic reaction of fly ash, the early strength of fly ash concrete is significantly reduced [1].The physical properties of a fly ash contribute to improvement of concrete quality. The majority of fly ash particles are spherical in shape. Workability and pump ability of concrete is improved with the addition of ash because of the increase in paste content, increase in the amount of fines, and the spherical shape of the fly ash particles. The use of fly ash may retard the setting of concrete. Fly ash concrete is less permeable because fly ashes reduces the amount of water needed to produce a given slump, and through pozzolanic activity, creates more durable C-S-H as it fills capillaries and bleed water channels occupied by water-soluble lime (calcium hydroxide).

Silica fume added mix gives higher strength values compared to their high volume fly ash counterparts at later ages (after 28 days)[2]. High-volume fly ash concrete can withstand high amount of energy before cracking. Further addition of metakaolin as partial replacement to cement in high-volume fly ash concrete progressively improves the impact resistance

Effect of Dolomite Powder on SCC as a Filler Material

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Abstract

The Dolomite Powder (DP), as a filler material has been used in the Self Compacting Concrete (SCC), which regulates the segregation of fresh concrete as well as rendering favorable impacts on the deformability of the SCC. This paper investigates the study of workability and durability characteristics of Self-Compacting Concrete (SCC) and containing dolomite powder as a filler material. The mix design for SCC was arrived as per the Guidelines of European Federation of National Associations Representing for Concrete (EFNARC). In this investigation, SCC was made by usual ingredients such as cement, fine aggregate, coarse aggregate, water and additional filler material (DP). The addition filler material levels (0%, 5%, 10%, and 15%). The super plasticizer used was Master Glenium SKY 8233 and the viscosity modifying agent used was Glenium Stream 2. The experiments are carried out by adopting a water-powder ratio of 0.45. Workability of the fresh concrete is determined by using tests such as: slump flow, T_{50cm}, V-funnel, L-Box and U-box tests. The durability of concrete is tested by acid resistance, Sulphate attack and saturated water absorption at the age of 28, 56 and 90 days.

Keywords: Self-compacting concrete, Dolomite Powder, Filler material, Master Glenium SKY 8233, Water powder ratio, Sulphate attack.

1.1 INTRODUCTION

Self – compacting concrete (SCC) is a fluid mixture, which is suitable for placing difficult conditions and also in congested reinforcement, without vibration. In principle, a self – compacting or self – consolidating concrete must:

(i) Have a fluidity that allows self – compaction without external energy

(ii) Remain homogeneous in a form during and after the placing process and

(iii) Flow easily through reinforcement

Self – consolidating concrete has recently been used in the pre – cast industry and in some commercial applications, however the relatively high material cost still hinders the wide spread use of such specialty concrete in various segments of the construction industry, including commercial and residential construction. The development of Self-Compacting Concrete (SCC) has recently been one of the most important developments in the building industry. The purpose of this concrete concept is to decrease the risk due to the human factor, to enable the economic efficiency, more freedom to designers and constructors and more human work. It is a kind of concrete that can flow through and fill gaps of reinforcement and corners of moulds without any need for vibrations and compacting during the pouring process.

Dolomite is a carbonate material composed of calcium magnesium carbonate $CaMg(CO_3)_2$. Dolomite is a rock forming mineral which is noted for its remarkable wet ability and dispersibility. Dolomite has a good weathering resistance. Dolomite is a preferred for construction material due to its higher surface hardness and density. Asphalt and concrete applications prefer dolomite as a filler material due to its higher strength and hardness.

Preethi.G et.al, In this paper examines the possibility of using dolomite powder as a partial replacement material to cement. The replacement percentages tried were 0, 5, 10, 15, 20 and 25% by weight of cement. The results indicate that replacement of cement with dolomite powder increases the compressive, split tensile and flexural strengths of concrete.

Deepa Balakrishnan.S et.al, In this paper, high volume fly ash self compacting concrete was produced with 12.5, 18.75, 25, and 37.5percent of the cement (by mass) replaced by

Soil Stabilization using Marble Sludge Powder

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Abstract

All over the world with a development of stone industry the waste generated in the natural stone processing plants it pose environmental pollution and economic problems. The useage of stone waste in various areas is still under research. In addition, there are only a limited number of studies concerning the use of stone waste obtained from processing plants in the stabilisation of Expansive clay soil. It is required when the soil available for construction is not suitable for the particular use. Of all the soils, Expansive soils causing major problems to the civil Engineering structures. Such soils are having high volume changes upon adding the water. In this study, waste marble dust which is the by product of marble industry, is used for the soil stabilization. Disposal of this waste creates serious problems to the humans surrounding them as well as acts as a pollutant so affect the ecological system of the environment So that, we decided to use the marble powder is used to improve the Engineering property of expansive soil, thus making it more stable and also to stabilize the soil with a very low cost material. The marble powder has very high lime (CaO) content and is reported Many researchers. We have added the marble powder to the expansive soil as 5%, 10% 15%, 20%, 25% and studied the compaction characteristics and strength characteristics.

1. Introduction

In Tamilnadu, Expansive soil is found in major part of VIRUDHUNAGAR. In it covers 193.3 hacter approximately 65-67 % land area. When the expansive soil comes in the contact of water then they causes swelling and when water content decreases shrinkage occurs in the soil. In geotechnical engineering, soil stabilization or other methods are required when a given site does not have suitable engineering properties to support structures, roads and foundations. One technique is to adopt the foundation based on geotechnical conditions at the site location. Another technique is to improve the engineering properties of the soils at the site location. Depending on the circumstances, this second technique may be the most economical for improving the soil and also this is achieved by mixing the soils with additives. Have reported that marble has very high lime (CaO) content up to 55 % by weight. Thus, stabilization characteristics waste marble dust is mainly due to their high lime (CaO) content. On the other hand, in the world, marble production amount was 21.7 million tons in the year of 1986; However in 1998, this was increased to 51 million tons. The proportion of marble discharged as waste during block production at the quarries is equal to 40-60% of the overall production volume Out of which only small portion of the waste marble products is utilized economically, most of them are stored on lands. Increasing of usage fields of waste marble products will eliminate the potentially harmful effects of them on environment and minimize the cost due to storage. Many research works have been done in the direction of utilizing of marble dust waste into the soil stabilization technique in worldwide. They reported that UCS and CBR value increases due to addition of these materials and also modify the engineering properties. The main aim is to improve the characteristics of black-cotton soil by using marble slurry. There was an improvement in compaction and CBR characteristics had reported that marble dust powder is effective waste material in the stabilization of expansive soil. Which improve the index and engineering properties of soil.

Soil Stabilization using Marble Sludge Powder

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Abstract

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Futuristic Contemplate on Hybrid Fibre Self Compacting Concrete

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Abstract

Self Compacting Concrete is a recently developed concept in which the ingredients of the concrete mix are proportioned in such a way that it can flow under its own weight and completely fill the formwork and passes through the congested reinforcement without segregation and self consolidate without any mechanical vibration. Several studies in the past have revealed the usefulness of fibres to improve the structural properties of concrete like ductility, post crack resistance, energy absorption capacity etc. Fiber reinforced self compacting concreting combines the benefits of self compacting concrete in fresh state and shows an improved performance in the hardened state due to the addition of fibers. In the present project, glass fibres and polyester fibres were added to self compacting concrete and Hybrid Fibre Reinforced Self Compacting Concrete was developed. An attempt has been made to study mechanical properties of self compacting concrete and glass fibre reinforced self compacting concrete with addition of mild steel reinforcement. A strength based mix proportion of self compacting concrete was arrived based on *Nan-Su method* of mix design and the proportion was fine tuned by using Okamura's guidelines. Self compacting concrete mixes with partial replacement of cement by mineral admixture like fly ash were taken for investigation with and without incorporating glass fibres and polyester fibres.

Keywords: Self Compacting Concrete, Glass Fibres, Polyester Fibres, Fly Ash, EFNARG.

Introduction

Current scenario in the building industry shows increased construction of large and complex structures, which often leads to difficult concreting conditions. When large quantity of heavy reinforcement is to be placed in reinforced concrete members it is difficult to ensure that the form work gets completely filled with concrete that is fully compacted without voids or honeycombs. Vibrating concrete in congested locations may cause some risk to labour and there are always doubts about the strength and durability of concrete placed in such locations. One solution for the achievement of durable concrete structures independent of the quality of construction work is the employment of Self Compacting Concrete (SCC).SCC is that concrete which is able to flow under its own weight and completely fill the formwork without segregation, even in the presence of dense reinforcement, without the need of any vibration whilst maintaining homogeneity. Hybrid Fiber Reinforced Concrete (HFRC) is composed of concrete, reinforced with glass fibers and polyester fibres to produce a thin, lightweight, yet strong material. Though concrete has been used throughout the ages, HFRC is still a relatively new invention. High compressive and flexural strengths, ability to reproduce fine surface details, low maintenance requirements, low coefficients of thermal expansion, high fire resistance, and environmentally friendly made HFRC the ideal choice for civil engineers. The strength of HFRC is determined by glass content, fiber size, fiber compaction, distribution and orientation.

Considering the advantages of SCC and HFRC an attempt has been made to combine these two and to produce Glass Fibre Reinforced Self Compacting Concrete (HFRSCC) and to investigate the and mechanical properties, of both SCC and HFRSCC.

II. Materials used in SCC

1. Cement

Ordinary Portland cement of 53 grade available in local market is used in the

Experimental Investigation on Flexural Behavior of RCC Beams Retrofitted with Coir and Glass FRP Sheets

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Abstract:
Reinforced concrete beams are the main structural elements which lead to local failure subjected to earthquake forces. As we know during earthquake large amount of energy is released and hence the structural element must have the ductility behaviour and enough energy absorption capacity to avoid the loss of life and property due to earthquake. Now a day authority insisted to incorporate the ductility code IS13920:1993 while designing structural elements. But we are in position to strengthen the existing structural elements which are already designed by IS456:2000 to meet the ductility requirement given by IS13920:1993. External confinement is one of the strengthening method. In order to improve the performance of the member Coir and Glass fiber sheet are used for retrofitting the structural elements. Four reinforced concrete specimen were casted one had reinforcement detail as per code IS456:2000(control) and another had reinforcement detail as per code IS13920:1993(control). The remaining specimen had reinforcement detail as per code IS456:2000 retrofitted with Coir and Glass Fiber sheet using epoxy resin (retrofitted). Both end of the beam were hinged. Static load (Two point load) was applied at the top of the beam up to a controlled load. An attempt has been made to know the performance of retrofitted specimens compared with control specimens.

Keywords: Retrofitting, Strengthening, Coir Fiber Sheet Retrofitting, Glass FRP Sheet Retrofitting, Flexural behavior of RCC Beams

1. Introduction:

In last few decades, moderate and severe earthquake have struck different places in the world, causing severe damage to reinforced concrete (RC) structure. Retrofitting of existing structure is a major challenge for modern civil engineering field facing these days. Recent evaluation of civil engineering structure has demonstrated is that most of them will need major repair in the future. Up gradation due to higher seismic zones of several cities and towns in the country has also necessitated in evolving new retrofitted strategies. . The external confinement of concrete by high strength Fiber Reinforced Polymer (FRP) composites can significantly enhance the strength and the ductility as well as result in large energy absorption capacity of structural members. FRP materials, which are available today in the form of sheets, are being used to strengthen a variety of RC elements to enhance the flexural, shear and axial load carrying capacity of elements.

2. Literature Review:

Anumol raj & Liji Anna Mathew et al., (2013) experimentally investigated the behavior of reinforced concrete beams retrofitted with various types of fibers externally. Carbon FRP, Glass FRP, Steel FRP, Polypropylene FRP & Coir fiber sheet used as retrofitting material and the beam size was 150x150x1000mm in M20, then 5 number of controlled specimens and 25 no. of retrofitted specimen were cast. Flexural strength (Two point loading) test was conducted for the specimen. From the test 125% increase in Carbon FRP, 89.6% increase in Glass FRP, 45% increase in Steel FRP, 38% increase in Coir FRP, 37% increase in PFRP. The ultimate load capacity of the beams improved due to external strengthening of beams. Out of these, Carbon fiber sheet have good result.

Tara Sen et al., (2010) experimentally investigated the behavior of retrofitted RC beam with control beams. Glass FRP used as retrofitting material. The prism size was 100x100x500mm. The

Experimental Study on Structural Behaviour of Light Weight Concrete Using LECA

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Abstract

This study examined the structural behaviour of Light Weight Concrete (LWAC) made with lightweight aggregates (Light expanded clay aggregates LECA™) and normal weight aggregates with the aim to investigate on concrete mix M_{25} is done the effect of partially and fully replacement of the coarse aggregate byLeca. The percentage like 20%, 40%, 60%, 80% and 100%.The fly ash percentage like 15%, 20%, 25% used as partial replacement for cement in concrete. Analysis of incorporated concrete was done in fresh state as well in hardened state to evaluate physical and mechanical properties of concrete. This paper concentrated on performance parameters such as compressive strength, splitting tensile strength, young's modulus, Flexural strength and unit weight, XRD, SEM and durability studies on concrete. To reduce the Lightweight concrete density varies from 40% -100%, such as1996kg/m^3-1597kg/m^3. The LWAC was compared to normal aggregate concrete. It reduces the weight of concrete and cost of concrete by reducing the aggregate cost and produces economical infrastructure system. In strength performance of 15% replacement of fly ash content with 40% replacement of coarse aggregates concrete for better results to ensure its optimal proportions.

Keywords: Light Expanded Clay Aggregate (LECA), Light-weight concrete, Strength, Density, Structural behaviour.

Introduction:

Light-weight concrete can be defined as a type of concrete which includes an expanding agent in that it increases the volume of the mixture while giving additional qualities like lessened the dead weight. It's lighter than the conventional concrete [1]. The required properties of the light-weight concrete will have a bearing on the best type of light Expanded Clay Aggregate to use. The Structural light weight concrete as we call is a concrete whose density varies from 1400 to 2000 kg/m^3[2].Theliteratures have thrown a light on influence of palm oil clinker, coconut shell, ceramic waste, Light expanded clay aggregate concrete to reduce the density of structural concrete member[3]. It reduces the weight of concrete and cost of concrete by reducing the aggregate cost and produces economic infrastructure system [4]. Light-weight concrete cubes, cylinders and beams are casted and tested for determining compressive strength, split tensile strength, flexural strength and young's modulus and obtain the results are compared with the control specimens.

1.1Literature Review

Light Expanded Clay Aggregate (LECA) was used as a part of fine aggregate for improving mechanical properties of porous asphalt. To conduct the experiment in this research, three different mixtures of stone material and LECA (0, 10 and 20 percent LECA) were used.The results of moisture susceptibility tests demonstrated that adding LECA to porous asphalt mixture can increase resistance against moisture damage in this mixture, MahyarArabani ,et-al [6]. The effect of using fly ash in high strength lightweight aggregate concrete produced with expanded clay aggregate on physical and mechanical properties of the concrete was investigated and in order to determine the effect of use of flyash in expanded clay aggregated concretes on bond strength, lightweight concrete mixtures of 350, 400, 450kg/m^3 cement content and of 0, 10, 20

Study on Strength Properties of No-Fine Flyash Based Geopolymer Concrete

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Abstract

This study evaluates the strength properties of flyash based no-fine geopolymer concrete. Flyash based geopolymer concrete is the developing alternative construction material of cement concrete. No-fine geopolymer concrete contains low calcium flyash, coarse aggregate and alkaline solution. This concrete have more pores hence less heat storage and high in permeable compare to normal concrete. No-fine concrete is used in low loading area parking, runway pavements, footpaths and walkways. Heat curing is required for geopolymer concrete. No-fine concrete mix is designed using ACI 522R-06 code. To overcome these difficulties, daylight curing is adopted in this experiment. Test specimens are casted and cured under different environmental conditions for different mix proportion. From the results, 1:6(18.75+10) give higher strength compare to other mix proportions.

Keywords: Geopolymer concrete, No-fine, Low calcium flyash.

Analysis of Shear Wall in G+9 Multi Storey Building

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Abstract

In seismic design of buildings reinforced concrete structural walls or shear walls act as major earthquake resisting members. The purpose of this study is to model and analyze assemblies of shear wall in multi storey structures. Shear wall assemblies are analyzed by static lateral load method where the proposed methods are used. The main aim is to determine the solution for shear wall in multi storey building. Effectiveness of shear wall has been studied with the help of different models. An earthquake load is applied to a building located in zone II, zone III, zone IV and zone V. parameters like deflection and shear required for ground floor are calculated in the cases replacing column with shear wall. The structure is analysed by using standard software (ETABS).

Keywords: Structure, Shear analysis, ESTABS.

Experimental Study on Flexural Behaviour of Steel Beam at Diverse Loading

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Abstract

Steel is one of the most sustainable construction materials. Its strength and durability coupled with its ability to be recycled again and again without ever losing quality make it truely compactable with long term sustainable development. Steel construction is placed in top list because it safeguards the building against damage in case of climatic effects like earthquakes and cyclones. In steel structures, channel sections are widely used because it has more shear capacity.

The flexural behaviour of channel section ISMC75 at different loading conditions is studied in this experiment. The specimen was tested under in a loading frame by applying loads at one third points for its pure flexural behaviour. From the experiment it was found that, the load carrying capacity of the channel section when applying load on flange portion is 47% higher than the load applied on web portion.

Keywords: Steel construction, Channel section, Two point Loading, Flexural behaviour.

Introduction

Structural steel is a solid material used for steel construction, which is fashioned with a specific shape following certain standards of chemical composition and strength. They can also be defined as hot rolled produces, with a cross section of different forms like angles, channels, beams and joints. There has been an increasing demand for structural steel for construction purposes in the United States and India. The structural steel all over the world predominates the construction development. This material has been comprehensively used in various constructions all over the world because of its various specific features that are very much preferably suited for construction.

Structural steel is long-lasting and also has unique physical property, ductility, because of which it is able to absorb large deformations beyond the elastic limit without fracture. It can be well molded to give the preferred shape to give an ultimate appearance to the structure that has been constructed .Several types of structural steel sections are used in construction like beam, channel, angles and flats. When the beam is adequately supported against lateral buckling, the beam failure occurs by yielding of the material at the point of minimum moment.

A significant difference between steel and concrete constructions is that the designer has more control over the shape of reinforced concrete elements. For building a steel structure normally to use standard rolled sections. The main advantages of steel structures are their smaller weight to strength ratio, speed of erection, dismantling and its scrap value.

The steel beam is thus capable of reaching its plastic moment capacity under applied load. In this paper reports only the flexural behavior of steel channel section with load at web and flange portion. The purpose of this investigation was to study the flexural behavior of section with load at web portion in comparison with load at flange portion.

Steel Channel section:

Steel channel sections are used preferably as supports and controller barriers. These are roll-formed products. The main metal used for making channels is steel along with aluminum. J, Hat, U and C sections are the certain variants that are available in the channels category. A major optional of the channel is the mild steel channel. Steel channels are commonly used in heavy industries. They are used in the heavy machinery industry and automotive industry too.

Study on Microstructure and Strength Parameters of Self Compacting Concrete Using Crimped Steel Fibres

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ABSTRACT

In this study was compared to normal vibrate concrete (NVC), self-compacting concrete (SCC) possesses enhanced qualities and improves production and working conditions due to the elimination of compaction. SCC generally has higher powder content than NVC and thus it is essential to substitute for some of the cement by additions to achieve an economical and durable concrete. Also SCC itself is brittle; in order to avoid that it is necessary to add fibers to achieve the ductility and tensile strength of SCC. The established benefits of using steel fibers in SCC led to the research on the possibilities of the use of crimped steel fibers of low aspect ratio in SCC. It is found that the steel fibers with high aspect ratio will reduce the physical properties like flow ability, segregation and compressive strength of concrete. In this study to evaluate the effect of various filler types on the fresh and hardened properties of self-compacting concrete (SCC) and Flowable concrete. For this purpose, two groups of fillers were selected. The first group was GGBS while the second group was dolomite powder. Generally Scanning Electronic Microscope (SEM) analysis and EDX & mapping were performed. Fibre volumes ranges from 0%, 0.5%, 1% & 1.5%. Cement is replaced by fly ash (20%), and in addition Dolomite Powder & GGBS (5%) were replaced for cement in various mixes. The cube compressive strength is measured.

Keywords: SEM, EDX & Mapping, Crimped Steel Fibres, Dolomite Powder, GGBS, Fly Ash.

INTRODUCTION

Self-compacting concrete (SCC), a new kind of high performance concrete (HPC) with excellent deformability and segregation resistance, was first developed in Japan in1986. It is a special kind of concrete that can flow through and fill the gaps of reinforcement and corners of molds any need for vibration and during the placing process.The concrete without vibration in not new. For examples, placement concrete underwater is done by tremie without vibration, mass been placed without vibration application of self-compacting (SCC) is focused on high perform and more reliability, dense surface texture, improved durab strength and faster construct performance required for concrete is more complicated and diversi concrete is required to have prope high fluidity, self compact abil strength, high durability, better ser and long service life of concrete In order to address these require Compacting concrete (SCC) developed.It is relatively new pro sees the addition of Super Plastici By its very nature, SCC does not vibration. It achieves compaction part of the mould or formwork means of its own weight wit segregation of the coarse aggregate.

SELF-COMPACTING CONCRE

Self-compacting concrete (SCC) as the concrete which can be pl compacted into every corner of purely by means of its self-w eliminating the need of either energy input from vibrators or any compacting effort. The intention developing this concrete was the regarding the homogeneity and com of cast-in-place concrete with in int paste. It is also referred as Self concrete, Super workable concr consolidating concrete, High flo concrete and Non-vibrating concrete

Experimental Study on Durability of Self- Compacting Concrete Using Steel Fiber

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Abstract:
Self-compacting concrete (SCC) is a unique kind of concrete that can flow through and fill the gaps of reinforcement and corner of mould without need for vibration and compaction during the placing process. Established benefits of using steel fibre in SCC lead to the study on the possibilities of the use of crimped steel fibre of 40 aspect ratio in SCC. An experimental investigation was carried out to study the effect of crimped steel fibre on Durability of SCC specimens, using four different fibre volume fractions (0.0%, 0.5%, 1.0%, and 1.5%). Physical properties were determined through J-ring, V-funnel and L-box tests. Mechanical characteristics measured permeability was performed by using plain concrete cubes. In the present investigation the main concentration is focused on durability of self compacting concrete. The accuracy of permeability measurements in SCC depends crucially on aperies determination of the flow volume. It is very important to consider its durability as it has indirect cause on economy serviceability and maintenance. So it IS important to discuss the Permeability characteristics of SCC as it has much bearing on durability.
Keywords: fly ash, GGBS, Dolomite Powder, Super Plasticizer.

I. Introduction

Self-compacting concrete (SCC), a new kind of high performance concrete (HPC) with excellent deformability and segregation resistance, was first developed in Japan in1986. It is a special kind of concrete that can flow through and fill the gaps of reinforcement and corners of molds without any need for vibration and compaction during the placing process. The application of concrete without vibration in construction is not new. For examples, placement of seal concrete underwater is done by the use of a termite without vibration, mass concrete has been placed without vibration. These seal, mass and shaft concretes are generally of lower strength, less than 34.5 MPa and difficult to attain consistent quality. Modern application focused on durability of self compacting concrete (scc).

To achieve this, mineral admixtures such as fly ash, GGBS, dolomite powder etc. and chemical admixtures like super plasticizer are used in the mix design of the concrete.

The performance required for concrete structures is more complicated and diversified. The concrete is required to have properties like high fluidity, self compact ability, high strength, high durability, better serviceability and long service life of concrete structures. In order to address these requirements Self Compacting concrete (SCC) was developed.

As per EFNARC Guidelines for SCC mix design, one of the most important differences between SCC and conventional concrete is the corporation of a mineral admixture

II Self-Compacting Concrete

Self-compacting concrete (SCC) is defined as the concrete which can be placed and compacted into every corner of formwork, purely by means of its self-weight, by eliminating the need of either external energy input from vibrators or any type of compacting effort.

The intention behind developing this concrete was the concerns regarding the homogeneity and compaction of cast-in-place concrete with in intricate, of paste (i.e. highly reinforced structures and improvement of overall durability, quality of concrete due to lack of skilled labours. This concrete is highly flow able and cohesive and enough to handle without segregation. It

Study on Mechanical Properties of Self Compacting Concrete using various proportions of Fly Ash

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stract

This project presents the experimental study on Self compacting concrete C) with replacement of cement by various percentage of Fly ash. The use of Fly ash in crete today is an important subject & is of growing importance day by day. using Fly ash concrete may provide both economical advantages & enhanced properties in the duction of concrete. The addition of Cera blast increases the workability of concrete. The n objective is to be determine the flexural strength , compressive strength & split tensil ngth on Self compacting concrete by partial replacement of cement by Fly ash %,40%,60%) .The work involves making seven types of SCCs mixes.For each mix aration,twenty one cube specimens,twenty one cylinder specimens and twenty one beam imens are cast and cured.The specimens are cured in water for 7 & 28 days.The slump e,U-BOX, L-BOX, J-RING and V-FUNNEL test are carried out on the fresh SCC.

words: Self compacting concrete, Cera blast, Fly Ash, Workability.

ntroduction

Self-compacting concrete (SCC) has resistance to flow so that it can be ed and compacted under its own weight little or no vibration effort. SCC has sity such that segregation and bleeding ot occur. SCC was developed in japan in ate 1980s as a solution to achieve ble concrete structures independent of quality of construction work [1].SCC is also reported to lower the noise on the construction site and diminish effect on the environment [2]. equently, the use of SCC as a ruction material has gradually ased over the last few years [3]. rally, SCC is produced using new ation Super plasticizers to reduce the r-binder ratio. In addition, mentary cementitious or inert ials such Fly ash are used to increase iscosity, workability and reduce the f SCC. The worldwide consumption of ete was estimated to be about 8.8 tons per year. Due to increase in ructure developments, the demand for ete would increase in the future. r, there will be a shortage of these raw als for the protection of Portland to rise by 4.7% globally to 3.5 metric ton in 2012 according to the recent world cement Research report. To meet the concrete performance requirements the following three types of self-compacting concretes are available.

1.1 Requirements of SCC

Increase of water-to-cementitious material increases the flow ability of cement paste at the cost of decrease in its viscosity and deformability the primary requirements of SCC. The SCC is flow able as well as deformable without segregation. Therefore in order to maintain deformability along with flow ability in paste, Super plasticizer is must in concrete. With Super plasticizers, the paste can be made more flow able with little decrease in viscosity. An optimum combination of W/C ratio and super plasticizers for achieving the self-compatibility can be derived for fixed aggregate content concrete.

1.2 Objective of this work

The main objective of this study is to achieve self-compacting concrete using Fly ash, Study fresh properties & hardened properties of self-compacting concrete & Experimental study on self-compacting concrete adding various percentage of Fly ash.

Experimental Study on Mechanical Properties of Concrete by using Marble Sludge Powder as Admixtures

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Abstract

Leaving the waste materials to the environment directly can cause environmental problem. Hence the reuse of waste material has been emphasized. Waste can be used to produce new products or can be used as admixtures so that natural resources are used more efficiently and the environment is protected from waste deposits. Marble stone industry generates both solid waste and stone slurry. Whereas solid waste results from the rejects at the mine sites or at the processing units, stone slurry is a semi liquid substance consisting of particles originating from the sawing and the polishing processes and water used to cool and lubricate the sawing and polishing machines. Stone slurry generated during processing corresponds to around 40% of the final product from stone industry. This is relevant because the stone industry presents an annual output of 68 million tones of processed products. Therefore the scientific and industrial community must commit towards more sustainable practices. There are several reuse and recycling solutions for this industrial by-product, both at an experimental phase and in practical applications. These industrial wastes are dumped in the nearby land and the natural fertility of the soil is spoiled. The physical, chemical and mechanical properties of the waste are analyzed.

In this project our main objective is to study the influence of admixtures used with marble powder, and to compare it with the compressive strength, tensile strength, flexural strength of ordinary M20 concrete. We are also trying to find the percentage of marble powder adding (4%, 6%, 8%, 10%) in concrete that makes the strength of the concrete maximum. marble powder of volume fractions 2, 6, 8, & 10% on Ordinary Portland cement concrete.

Keywords: Ordinary Portland Cement, Marble Powder, Compressive Strength, Split Tensile Strength, Flexural Strength.

Introduction

Marble is one of the most important materials used in buildings since ancient times, especially for decorative purposes. However its powder has bad effects on the environment, soil, water and health problems. Marble powder is produced from processing plants sawing and polishing of marble blocks. Some factories have water recycling plants containing flocculation tank and filter press unit. About 25% of the processed marble is turn into dust or powder form. About 7,000,000 tons of marble have been produced in the world. Disposal of the marble powder material of the marble industry is one of the environmental problems worldwide today.

The refining of some fresh and hardened properties of concrete is successfully and economically achieved by utilizing and using some admixture materials such as mineral additions such as fly ash, silica fume, and marble powder. Several researchers studied the influence of using fly ash and silica fume on the properties of normal concrete, high strength concrete. In recent years many researches proved that mineral admixtures can be successfully and economically utilized to improve some fresh and hardened concrete properties. Furthermore, the use of marble powder for the production of concrete were investigated and proved that they could be used to improve the mechanical properties.

Materials used and Mix Details

a) Cement

The cement used is chettinad OPC 53 grade cement. The Ordinary Portland Cement of 53 grade conforming to IS: 12269-1987 was used. Tests were conducted on cement like Consistency tests, Setting tests, Specific gravity test, and Fineness modulus test. The

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Influence of Tube Length on Blast Protection System with Metallic Tube Core Sandwich Panels

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ABSTRACT -

Effect of blast loads from explosion can be mitigated by using thick armor systems that are often heavy and significantly affect the self-weight of the structure. In the design of structure for blast protection sacrificial claddings which consist of high energy absorbing elements are used. A sandwich type protective structure consists of light weight core which are often used for blast mitigation. The choice of core type has an influence on the performance of sandwich panel. The cores can be of wood, foam material and tubular elements. In this study, behavior of sandwich panel with square tubular core is investigated through numerical studies. Panel is made of mild steel having top plate dimension of 150 mm x 150 mm x 2.5 mm; bottom plate of 150 mm x 150 mm x 5 mm and square tube core of 12.5 mm x 12.5 mm with 0.6 mm thickness. A finite element model is developed and validated using experimental results available in literature. Parametric studies are also carried out using the validated finite element model. By varying the tube length of the core, the responses of the panels are compared in terms of energy absorption and reaction forces.

Key Words *- Blast; Tube core sandwich panel; Energy absorption; Reaction forces.*

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SPECIMEN SIZE EFFECT ON ULTRA HIGH STRENGTH GEOPOLYMER CONCRETE (UHSGC)

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ABSTRACT

This paper reports an experimental study carried out to investigate the specimen size effect of Ultra High Strength Geopolymer concrete (UHSGC) cubes, cylinder and suggest the equations for the prediction of compressive strength with specimen size. Ambient cured Ultra High Strength Geopolymer concrete mixtures were created by activating industrial by-product materials like Ground granulated blast slag (GGBS) and Silica Fume (SF) by completely excluding Portland cement. Past a decade, vast research has been carried out on Geopolymer concrete. Since the performance of Geopolymer concrete mainly depends upon the quality of the ingredients, packing structure of the concrete mix, rate of Geopolymerisation etc. The reaction mechanism of Portland cement concrete and Geopolymer concrete are completely different. The UHSGC mix is prepared by totally excluding Portland cement by industrial waste materials like GGBS & SF, Standard sand (max 2mm), quartz sand (600μm) and 0.14mm □steel fibres (2% by volume of concrete) of 13mm length having the aspect ratio of 92.5 were used. The compressive strength of ambient cured UHSGC (2% steel fibre) were evaluated. The highest average compressive strength obtained for cubes & cylinder were 143.40 N/mm^2, 75 N/mm^2& 94.55 N/mm^2, 46.61 N/mm^2 with and without steel fibres respectively.

Keywords - Compressive strength; Geopolymer Concrete; grand granulated blast slag; Silica Fume.

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INVESTIGATION STUDY ON THE USE OF EPOXY RESIN IN SELF HEALING CONCRETE

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Nagarajan S[3], Rajadurai K[3], Uthrakumar M[3], Vijay M[3]

ABSTRACT

Concrete is a composite material composed of coarse granular material embedded in a hard matrix of material that fills the space among the aggregate particles and glues them together. Concrete experiences various loading from heavy vehicles, Earthquakes and strong winds. Due to this factor in addition to several more it is inevitable that reinforced concrete eventually develop cracks. When cracks originate in concrete structures, a sequence of serious events begins to occur within those structures. Not only this cracks affect the functionality of the structures, they also affect the durability and strength of the structure. Self Healing Concrete emerges now a day's which has healing agents like Polyurethane, Silica gel, Epoxy Resin which automatically arrest the cracks in the structural elements and it is normally said to be Self Healing. The available self healing agents are Polyurethane, Silica gel, Epoxy Resin. For repairing the type of cracks the healing agents are used. The healing agent is prepared by using ethylene di-amine as a curing agent and poly vinyl alcohol as an emulsifying agent. The resulting chemical is encapsulated and mixing with concrete during casting. After the curing time of concrete, it is subjected to initial loading. This is causing the rupture of capsules. The healing agent is released into the repairing zone. Where it will penetrate into cracks and rebound to mother cement and materials of structure and it will repair damage.

Keyword:
Epoxy Resin, EDA(Ethylene di-amine), Polyvinyl alcohol, Capsulation, Self healing.

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STRENGTH STUDY OF M-SAND & FLY ASH BASED GEOPOLYMER CONCRETE

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ABSTRACT

Concrete is till now the most popular material in construction and one of the most environmentally harmful materials. During the manufacturing of Ordinary Portland cement (OPC), this released a large amount of greenhouse into the atmosphere causing global warming. Geopolymer is such an alternative material which can act as a binder replacing cement. It mainly makes use of waste byproduct substances like fly ash, which is not expensive and will diminish environmental pollution to a large extent. Fly ash is one of the major waste materials available for thermal power plants. Low calcium fly ash is preferred as a source material than high calcium fly ash because of to reducing more CO_2 emissions. River sand is mined from the river beds and sand mining has disastrous environmental consequences. To overcome this tribulation the alternative material required so M-Sand is used as a replacement of river sand. Alkaline liquid (sodium hydroxide, sodium silicate) are used in this project as a binder. It is used in geopolymeriztion process. In this paper the fresh and hardened mechanical properties of geopolymer concrete have been studied and compared with conventional concrete.

Key words—Fly ash; Geopolymer concrete; M-Sand, Mechanical properties

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EXPERIMENTAL STUDY ON FLEXURAL BEHAVIOR OF FIBER REINFORCED GEOPOLYMER FERROCEMENT FOLDED PANEL

C.MANIKANDAN[1], S.DHARMAR[2]

ABSTRACT

Ferrocement is a highly adaptable construction material and acquire high performance characteristics, particularly in cracking, strength, ductility, and impact resistance. The ferrocement reinforcement is uniformly distributed in both direction and closely spaced through the thickness of the section. There is abundant scope for mass production and standardization together with the economy in construction. Ferrocement is appropriate for low-cost roofing, precast units and manhole covers. It is also used for the construction of domes, water tanks, boats, silos and folded plates. Geopolymer is an innovative revolutionary green material. An experimental investigation on ferrocement folded panel with geopolymer mortar and polypropylene fiber has been conducted for various mix proportions and fiber ratio. The results show that the flexural strength of the folded panel increased with the addition of fiber and also concluded that the addition of fibers increased the ductility and decreased the crack development and spilling of cement matrix.

Key Words—Geopolymer Mortar; Ferrocement; Fiber; Folded Panel.

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Experimental Study on Flexural Behaviour of Reinforced Concrete Hollow Core Sandwich Beams

MANIKANDAN.S [1] DHARMAR.S [2]

ABSTRACT

Nowadays research efforts are continuously looking for new, better and efficient construction material and method. We have responsibility to reduce the effect of the application of concrete materials to environmental impact. The concrete should be used as efficiently as much as possible. In this article, we focus on structural material optimization by introducing hollow core using Expanded Polystyrene Foam in tension zone of RC beams. By material optimization, we can reduce the dead loads which contribute to seismic effect in high rise structures. In addition, the hollow core will act as vibration dampers during earthquake and heat insulator. This paper presents details of the studies carried out on flexural behavior of Hollow Core Sandwich RC Beams with different core shapes. The experimental program consists of casting and testing of RC beams of size 1500mmx150mmx200mm with and without hollow core in tension zone. To study the flexural behavior, all beams are tested after 28 days curing by applying loads at 1/3rd points. The performance of Hollow Core Sandwich Beams under flexure shows better when compared with conventional solid beams.

Keywords *— Ductility Factor; Flexural Behaviour; Hollow Core; Optimization; Strain Behaviour*

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EXPERIMENTAL STUDY ON INFLUENCE OF CURING PERIOD ON STRENGTH OF GEOPOLYMER CONCRETE

S.Jemin*, B.Kavitha*,K.Manju*,S.Dharmar**

ABSTRACT

The use of mordern day cement contributes to 14 billion tonnes of Carbon Dioxide (co_2). The production of cement is responsible to produce on ton of co_2 per one ton of cement produced and the cement manufacturing industry is causative to a contribution of 12% of global co_2 emission, which is one of the green house gases that causes climatic due to global warming.

Due to Fly ash's property which has strong Silica Alumina glassy chain, it has been used as supplementary cementing material to substitute Ordinary Portland Cement (opc). It has already been used as pozzolona for a long term with cement due to this pozzolanic property.Strong Alkali Activator is used to break the Silica Alumina chain to enhance the polymeric process of flyash form a cementitous. This process is termed as polymerization by Davidovits.

Geopolymer cement is obtained from the reaction of low calcuim fly ash with the Alkaline Solution such as Sodium Hydroxide and Sodium Silicate the geopolymer cement does not pollute environment .so it is Eco Friendly .Hence the geopolymer concrete has the potential to reduce green house emisssion from the concrete industry by 80%. Also this method can reduce the water scarcity and waste disposal of fly ash . Most of the literature reviews shows that curing period of geopolymer concrete is 24 hrs at 60^0 c . In this study ,geopolymer concrete cubes of size 150X150X150 mm were cast . using geopolymer concrete of M25 garde and are placed for heat curing in a digital controlled heat curing champer at 70^0c for 12hrs,24hrs,36hrs,48hrs,72hrs to assess the optimum curing period and strength. After curing, the cubes are tested in compressive Testing Machine. The results shows that increase in compressive strength with respect to increase in curing period .

Keywords *: Geopolymer, Fly ash, Alkaline Solution, Curing Period ,Curing Temperature.*

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EXPERIMENTAL STUDY ON FLY ASH BASED ON SELF-COMPACTING GEOPOLYMER MORTAR

PORKODI.R[1], DHARMAR.S[2]

ABSTRACT

Geopolymer technology is one of the radical technologies. The main problem of global warming is CO_2 emission, during the cement production. This problem can be minimized by replacing the cement with fly ash. When the cement is used as a binder for the construction, it requires more a amount of water for mixing, curing and the period of curing is also very long. Ferrocement construction is a type of thin reinforced concrete, laminate commonly constructed with hydraulic cement mortar. In thin density reinforced elements, it is difficult to proper compaction. To overcome the above problem, self-compacting geopolymer mortar is introduced. This study was carried out to check the strength properties of self-compacting geopolymer mortar for various mix proportions. Mortar cubes of size 70.6x70.6x70.6 mm are casted and cured at 70°C for 24 hours in the oven. The workability of fresh mortar was determined using slump flow, V-funnel, U-Box, J-Ring, and V-funnel at T5 minutes as per EFNARC guidelines. The results show better performance than conventional cement mortar.

Keywords —Flyash; Self-Compacting Geopolymer Mortar; Sodium Hydroxide; Sodium Silicate; Fiber

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EXPERIMENTAL STUDY ON EFFECT OF CURING TEMPERATURE ON STRENGTH OF GEOPOLYMER CONCRETE

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ABSTRACT

GeoPolymer Concrete (GPC) is a type of amorphous alumino-hydroxide product that exhibits the ideal properties of rock-forming elements such as hardness, chemical stability and longevity. The properties of geo polymer include high early strength, low shrinkage, freeze-thaw resistance, sulphate resistance and corrosion resistance. Considering the increasing demand for developing alternative construction materials, due to the growing environmental concerns, this paper discusses the feasibility of alkali activated geo-polymer concrete binding with fly ash in place of cement as a future construction material. The fly ash reacts with alkaline solution form a gel which binds the fine and coarse aggregates.

The main objective of this study involves observation of structural behaviour of the fly ash based geo-polymer concrete under various temperature condition for 24 hours curing. Concrete Cubes of size 150mmX150mmX150mm using low-calcium fly ash based Geopolymer Concrete of M25 grade were cast to study the effect of various parameters on compressive strength. The ratio of alkaline liquid to fly ash and NaOH to Na_2SiO_3 are 0.5, 2 respectively. Samples are demoulded after 5 days rest period. Then the samples are heat cured at various temperature of 60^0c, 70^0c, 80^0c ,90^0c, 100^0c and 110^0c for 24hrs in hot air oven to assess the optimum curing temperature and strength. After curing, geopolymer concrete cubes were taken to strength test in Compressive Testing Machine. The compressive strength test was conducted on each sample and the results shows there was an increase in compressive strength with respect to increase in temperature. At the same time, density of geopolymer concrete was also checked and the value is around 2400kg/m^3 which is equivalent to that conventional concrete. Hence, geopolymer concrete has a great potential for utilization in construction industry as it is environmental-friendly and also facilitates the use of fly ash, which is a waste product from coal burning industries.

Key words: *GeoPolymer , Fly Ash , Alkaline solution , Heat Curing.*

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INFLUENCE OF MUNCIPAL WASTE COMBUSTION ASH ON STRENGTH OF CONCRETE

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ABSTRACT

The municipal solid waste is occupied large amount of land in the world. In India 366 cities generate municipal solid waste of around 188500 tons per day (TPD) or 68.8 million tons per year (TPY) the past year (1947-2011),the Municipal Solid Waste(MSW) occupied 380sq.km land area in Chennai. Future forecasting (2009-2047) MSW occupy 1400sq.km.Muncipal Solid Waste basically responsible for spreading various kind of diseases. The most common causes for bacillary dysentery , amoebic dysentery and diarrheal disease. Over the past several years, there has been significant controversy concerning the proper management of the residues from combusting municipal solid waste (MSW) and their regulatory classification as hazardous or non-hazardous wastes. Incineration of municipal waste combustion ash has become an important waste disposal because it provides an effective means of reducing the volume of MSW as well as providing an important source of energy. In this paper we made an attempt to use Municipal Waste Combustion (MWC) ash in Civil Engineering. So we collect of MWC ash and tested regional testing laboratory in Madurai. The test result gives the following characteristics present in MWC ash such as SiO_2 and Al_2O_2 (53.21%),silica(30.38%), MgO (4.08%),SO_3(1.59%), Na_2O(1.99%). So, MWC ash is used to produce a geopolymer concrete. Geopolymer is a material resulting from the reaction of a source material that is rich in silica and alumina with alkaline solution. Geopolymer concrete is totally cement free concrete. In geopolymer, fly ash act as binder and alkaline solution act as an activator. Fly ash and alkaline activator undergo geopolymerization process to produce alumino-silicate gel. Due to high calcium and silica content present in the MWC ash, also we can replace partially to cement and sand. In this paper we studied the strength of mortar by partially replacing cement and sand with MWC ash and be result shows better.

Keywords: Geopolymer Concrete, MWC Ash, Alkaline Solution, Sand and Cement Replacement.

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EXPERIMENTAL STUDY ON STRENGTH PERFORMANCE OF LIGHT-WEIGHT CONCRETE USING CINDER

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ABSTRACT

Experimental studies have been carried out to compare the compressive strength, spilt tensile strength, flexural strength, unit weight and workability between lightweight aggregate concrete (LWAC) made with partial replacement of burnt coal cinder by 20%, 40%, 60%, 80% and also full replacement of coarse aggregate with normal weight concrete (NWC). The 28-day compressive strength and the dry concrete density of 0%, 20%, 40%, 60%, 80% varied from 34.6 to 19.29MPa and from 2375 to 1815 kg/m^3. Using the study results, optimized the concrete mix proportion and prepared C_3 60% cinder LWAC with density level 1900kg/m^3 with optimal fly-ash mix concrete for further study of strength behaviour.

Keywords - *Cinder Aggregate; Density; Light-weight concrete; Strength; Structural behaviour.*

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EXPERIMENTAL STUDY ON STRENGTH PERFORMANCE OF LIGHT WEIGHT CONCRETE USING LECA

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ABSTRACT

This study examined the structural behaviour of light-weight concrete (LWAC) made with lightweight aggregates (Light expanded clay aggregates LECA) and normal weight aggregates with the aim to investigate the effect of partial replacement of the normal weight aggregates. The paper concentrated on performance parameters such as compressive strength, splitting tensile strength, flexural strength and unit weight. The LWAC was compared to normal aggregate concrete. The good results obtained for this type of LWAC relative to normal weight concrete, there is no certain mix proportion that can be generally used, as is the case for normal weight concrete, and more studies are still needed to ensure its optimal proportions.

Keywords— *Density; Light Expanded Clay Aggregate (LECA); Light-weight concrete; Strength; Structural behaviour.*

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EXPERIMENTAL STUDY ON DURABILITY OF LIGHTWEIGHT CONCRETE

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ABSTRACT

Lightweight aggregate is a type of coarse aggregate that is used in the production of lightweight concrete products such as concrete block, structural concrete, and pavement. Most lightweight aggregate is produced from materials such as clay, shale, or slate. Blast furnace slag, natural pumice, vermiculite, and perlite can be used as substitutes. To produce lightweight aggregate, the raw material (excluding pumice) is expanded to about twice the original volume of the raw material. The expanded material has properties similar to natural aggregate, but is less dense and therefore yields a lighter concrete product.

Durability can be defined as the ability of material to withstand the effects of its environment. In the building material it may be interpreted as chemical attack, water absorption and carbonation. Chemical attack usually encountered as aggressive groundwater, particularly sulphate, polluted air and spillage of reactive liquids. A chemical aspect of durability is the stability of the material itself, particularly in the presence of moisture.

Concrete made with lightweight aggregate exhibit a higher moisture movement than in the case with normal weight concrete. The durability of lightweight aggregate concrete depends on some factors; they are resistance to freezing and thawing, permeability, resistance to sulfate attack, and Carbonation.

In this project the study about the durability of lightweight concrete to chemical attack will be done by conducting experiments.

Key Words: Lightweight Concrete, Curing, Chemical Attack, Durability

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MICROSTRUCTURAL INVESTIGATION OF LIGHTWEIGHT CONCRETE

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ABSTRACT

The Awareness of lightweight concrete is steadily increasing because of disadvantages and scarcity of raw materials of conventional concrete like environmental hazards and economic considerations. Hence, the inherent internal and external features of lightweight aggregates have been a subject of intense research in recent years. With increasing concern over the excessive exploitation of natural aggregates, synthetic lightweight aggregate produced from environmental waste is a viable new source of structural aggregate material. The uses of structural grade lightweight concrete reduce considerably the self-load of a structure and permit larger precast units to be handled. This study provides new insight into the microstructural and chemical factors which influence the strength properties of structural lightweight aggregate concrete. These are containing various types of lightweight aggregate and proportions of dispersing agents such as water-reducing admixtures and superplasticizers. The microstructural characteristics of the paste-aggregate interface and the paste porosity of these concretes are discussed. The methods used include compressive strength testing, scanning electron microscopy-energy-dispersive X-ray analysis, X-ray diffraction analysis. In this project, the mechanical properties of a structural grade lightweight aggregate made with expanded clay(leca), cinder aggregate will be studied.

KEYWORDS:

Lightweight aggregate concretes, expanded clay, compressive strength, water absorption, microstructure, porosity, paste-aggregate interface.

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Paper ID: RACE15/PSR/060

FLEXURAL BEHAVIOUR OF SELF COMPACTING CONCRETE WITH CRIMPED STEEL FIBRE AND SILICA FUME

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ABSTRACT

Self-compacting concrete is a highly workable concrete without any vibration and under its own weight fills the formwork it also passes through small spaces between rebar's. when silica fume was used as a cement replacement , it enhanced the effectiveness of added crimped steel fiber on the properties of concrete using different steel fiber volume fraction were investigated in sec. silica fume was introduced at some percentage by weight of cement into the concrete mixtures that were made with water cement ratio. eheological Property were determined through slump flow time and diameter v-funnel flow time test .mechanical characteristics were obtained through compressive strength test with standard cube cylindrical specimen and flexural strength test were performed by using beam the experimental study indicate that the inclusion of crimped steel fiber in silica fume specimen led to the highest long term compressive strength and lowest resistivity furthermore an improvement in the dynamic frequency and decrease in water absorption were attained by adding crimped steel fiber and silica fume specimen.

Key words *– Scc, Crimped Steel Fiber, Silica Fume, Super plasticizer , Flexural Strength*

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EXPERIMENTAL STUDY ON STRENGTH OF GEOPOLYMER CONCRETE UNDER DAYLIGHT CURING

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ABSTRACT

Environmental pollution is the biggest menace to the human race on this planet today. In the construction industry mainly the production of Portland cement will causes the emission of pollutants. Nearly 120 million tone of fly ash get accumulated every year at the thermal power stations in India. In order to reduce the effect of above problems by increasing the usage of industrial by-products in our construction industry. In the present study, Geopolymer concrete is one in which the Portland cement is fully replaced with flyash and alkaline solution are used as binding materials. Generally, geopolymer are adopted in precast construction which requires heat curing. But it is not possible in cast-insitu. Hence Daylight curing is adopted for to overcome these difficulties. The cube specimens are taken of size 150mm x 150mm x 150mm.Two different curings are carried out i.e, curing the geopolymer concrete specimens directly by placing to daylight and the temperature is noted daily. Curing the conventional concrete specimens directly by immersing the specimens into water. The concrete specimens are tested for their compressive strength at the age of 3,7,14,21,28 days and graphical comparison is developed between strength of geopolymer in daylight curing and strength of normal concrete with water curing.

Keywords: *Geo-polymer, fly ash, Alkaline solutions, curing, compressive strength.*

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MECHANICAL BEHAVIOUR OF CONCRETE WITH PARTIAL REPLACEMENT OF CEMENT WITH LIME SLUDGE.

S.Balasundari*, J.Durga*, V.Suganya*, L.Arun Raja**

ABSTRACT

The increased demand of drinking water and power has led huge generation of water treatment plant residue i.e. sludge and the thermal power plant by-product. Large quantities of sludge and fly ash are produced in India and disposed off by landfilling or dumping in and around sites. In this study water softening sludge (lime sludge) has been utilized in concrete. The effect of various combinations on strength has been discussed here.

The paper outlines the composition of the composite material, method of preparation of mortar specimen, testing procedure and salient results thereof. In this research study the cement has been replaced by lime sludge accordingly in the range of 5%, 10% and 15% by weight of M-25 grade concrete.

Concrete mixtures will be produced, tested and compared in terms of compressive strength to the conventional concrete. The tests will be carried out to evaluate the properties for 7, 14 and 28 days. Results will show that the replacement of appropriate lime sludge content able to produce workable concrete with satisfactory strength.Keeping all this view, the aim of the investigation is to study the behaviour of concrete while replacing the lime sludge with different proportions in concrete.

Keywords *: Lime Sludge, Cement, Compressive Strength, Split tensile Strength*

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NECESSITY OF MADURAI - KANYAKUMARI DOUBLE RAILWAY LINE.

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ABSTRACT

The transportation plays an important role in developing country .In modes of transport , Railways plays an important role. Because,it carries large people with minimum expenditure.so,in our country most of the people use Railway network elaborately.Large number of people travelled in Railway,it will meets tremendous development.In the world more number of labours {1.3 crores} working in our Indian Railway only. But, in Railway development doubling of track is necessity for fast reach of track in time for people.In our Tamilnadu, most revenue gained in the route " CHENNAI TO KANYAKUMARI".It covers most of the districts , daily usage of people in the line is more than five {5lakhs},and annual expenditure is nearby {500 crores}.More trains can flow in this region. So,southern Railway provide double track and electrification laid between "CHENNAI-MADURAI" and completed in 2012.Now this project shows remaining secton "MADURAI-KANYAKUMARI"double railway line is necessary or not.

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A CASE STUDY ABOUT INTERCITY EXPRESS ACCIDENT

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ABSTRACT

The project entitled "The Case study about Intercity express " is about the accident of the Intercity express and the factors which were the causes for the accident. In addition to this it gives a detailed study about the people who were responsible for the accident. It also shows the reaction of railway department,the police and the people .

Keywords—ANSYS;accident,railwaydepartment,responsible.

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EXPERIMENTAL STUDY ON TREATMENT OF GREY WATER BY USING NATURAL AND CHEMICAL COAGULANTS

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ABSTRACT

The water scarcity is a major problem in the whole world. The rainfall also gets reduce due to global warming, climate changes and urbanization, rapid growth of industrialization and deforestation. So water scare places lots of bore wells provide by the people. The reason ground water level get too short. So we have a special plan for increase the ground water level by using treated grey water. Turbidity imparts an enormous problem in greywater treatment. In this present study, an attempted has been made to evaluate the effectiveness of locally available tamarind seed powder as natural coagulant for reduction of turbidity in the quality improvement of greywater. It was found that natural coagulant worked better with turbid water. The turbidity reduction efficiency of about 78% was achieved by using tamarind seeds. The coagulation process was used to treat detergent wastewater with ferric chloride as coagulant. Using clay minerals at the dose of 500 mg/L with ferric chloride provided 84% of COD removal efficiency. And also use chemical treatments method adopted for breaking the harmful effect of sulphates, chlorides. And reduce the hardness by using (adding lime or boiling) suitable method. Finally treated water used for domestic use and also some quantity of water used to discharge into the ground by penetration way. So the ground water level increases by our project.

KEYWORDS:

Greywater, Tamarind seeds, Ferric chloride

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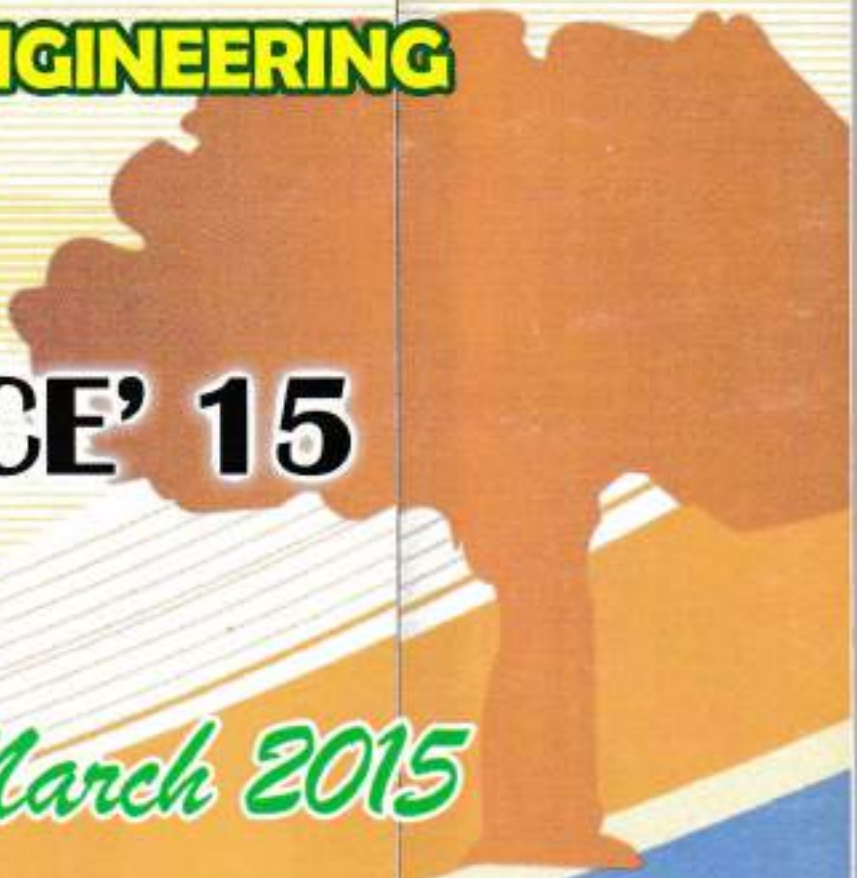

RACE' 15

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CONTENT

S.No	PAPER ID	TITLE AND AUTHOR	Page No.
1	RACE15/PSR/001	EXPERIMENTAL INVESTIGATION ON CELLULAR LIGHTWEIGHT CONCRETE BLOCKS FOR VARYING GRADES OF DENSITY R.Jeyanthi, P.Manikandan, R.Aravinth, S.Venkadesh	1
2	RACE15/PSR/002	UTILIZATION OF CHICKEN FEATHER IN CONCRETE FOR LOW-COST BUILDING CONSTRUCTION Pranavan S. and Manikandan S.	2
3	RACE15/PSR/003	STABILIZATION OF BLOCK COTTON SOIL USING SODIUM SILICATE Ms.M.PETCHIYAMMAL M.Karthick, P.Ramakrishnan, P.Sankara Narayanan	3
4	RACE15/PSR/004	ASSESSMENT OF NITRATE CONCENTRATION IN GROUND WATER AND MODELING USING VISUAL MODFLOW R.K.C. Jeykumar, B.Jacob	4
5	RACE15/PSR/005	BEHAVIOR OF PARTIAL REPLACEMENT OF COARSE AGGREGATE WITH RUBBER (TYRE) & USING ADMIXTURES (SILICA FUME) R.Nandhini, R.Ramya, K.Vaisalii	5
6	RACE15/PSR/006	COMPARISON OF CONVENTIONAL FORMWORK AND FALSEWORK WITH ADVANCED SYSTEM (DESIGN CONCEPT OF BRIDGE) K.S.Harishkumar, D.Kumaran, A.Sathishkumar, M.Selvakumar	6
7	RACE15/PSR/007	DURABILITY STUDY ON GGBS BASED POLYPROPYLENE FIBRE REINFORCED GEOPOLYMER BEAM Niranjala Paldano, Dr.S.Nagan	7
8	RACE15/PSR/008	DYES REMOVAL FROM TEXTILE WASTEWATER USING NATURAL ADSORBENTS T.Rama, P.Arunpandi, P.Rajeshkannan, A.Vigneshkumar	8

9	RACE15/PSR/009	EXPERIMENTAL ANALAYSIS OF THE COMPRESSIVE STRENGTH OF CONCRETE FOR PARTIAL REPLACEMENT OF OVER BURNT BRICK BALLAST AGGREGATE G.Kandhasamy M.J Seshan,R.Jeyaram,M.Muthukaruppasamy	9
10	RACE15/PSR/010	EXPERIMENTAL STUDIES ON CONCRETE WITH E-PLASTIC WASTE AS PARTIAL REPLACEMENT OF COARSE AGGREGATE G.T.Koteeswaran P.Sasikala	10
11	RACE15/PSR/011	EXPERIMENTAL STUDY ON E-WASTE IN SELF CURING CONCRETE V.Gopi, R.Kartheeskumar, S.Rajendraprad	11
12	RACE15/PSR/012	EXPERIMENTAL STUDY ON BRICKS WITH AGRICULTURE WASTE, FLY ASH AND QUARRY DUST R.Venkatsaravanan, K.R.Sivakumar, R.Selvakumar, A.Vijay	12
13	RACE15/PSR/013	EXPERIMENTAL STUDY ON FIRED MASONRY BRICKS WITH CLAY, FLY ASH AND POND ASH A.L.Meenaabhavani and C.Vignesh, C.Srinivasan M. Ameenul buhari	13
14	RACE15/PSR/014	Experimental Study on Partial Replacement of Cement by Red Mud in Concrete H.Jeniston David Raj[1] A.Alagar raj, S.Arun Kumar, S.Praveenkumar, K.Venkateshwaran	14
15	RACE15/PSR/015	EXPERIMENTAL STUDY ON SELF-CURING CONCRETE WITH AN ADDITION OF SHRINKAGE REDUCING ADMIXTURES R.Iswarya M.Jeyasri K.Nithya A.L.Meenaabhavani	15
16	RACE15/PSR/016	INTERPRETIVE STRUCTURAL MODELING FOR TRAFFIC FACTOR ANALYSIS IN MADURAI CITY Nancy Debora[1], Yoganandhan.U, Vel Kennedy	16
17	RACE15/PSR/017	RAIN WATER HARVESTING SYSTEM FOR RESIDENTIAL BUILDINGS, INSTITUTIONAL BUILDING INCLUDING CATCH DRAINSAND SOIL EXPLORATION Prof.T.Mari, T,Dhanasekaran	17

9			
10			
11			
12			
13			
14			
15			
16			
17			
18	RACE15/PSR/018	SMART BUILDING AGAINST GLOBAL WARMING Prof.T.Mari, S.Ganesaguru	18
19	RACE15/PSR/019	SOIL EXPLORATION FOR RAINWATER HARVESTING AND FOUNDATION STUDIES F.Shilpha Lancy, B.Krita, D.Thirumala Prof.T.Dhanasekaran, Prof.S.Ganesaguru	19
20	RACE15/PSR/020	EXPERIMENTAL AND ANALYTICAL ANALYSIS OF ENCASEMENT OF CIRCULAR COLUMNS USING GFRP B. Rizha-ur-rahman. A.Nasar ali.	20
21	RACE15/PSR/021	SULPHATE WATER HARDNESS IONS REMOVAL FROM THE WATER IN USING DEMINERALIZATION PROCESS S.Ravi sankar, C.Sakthivel, P.S.D.Sripaul S.Venkatasaravanan	21
22	RACE15/PSR/022	PERFORMANCE OF HOSTEL WASTE WATER TREATMENT USING NATURAL MATERIAL AS FILTER MEDIA T.Rama, P.Vijayaragavan, P.Anandakumar, P.Xavier	22
23	RACE15/PSR/023	Experimental Study Of Light Weight Concrete By The Partial Replacement Of Coarse Aggregate By Thermo Plastics Mr.H.Jenistondavidraj, A.Karthik, J.Rajivgandhi, S.Sankarapandi	23
24	RACE15/PSR/024	EXPERIMENTAL STUDY OF CURING COMPARISION BETWEEN COMPRESIVE STRENGTH OF POLYETHYLENETERETEREPHTHALATE(PET) FIBER CONCRETE TO PET CONCRETE WITH SUPER ABSORPTION POLYMER (SAP) Mr.S.SuriyaprakashS.Singaraj,K.Thiruppathi,B.Vijay anand	24
25	RACE15/PSR/025	STUDY OF FLUORIDE REMOVAL FROM GROUND WATER BY NATURAL ADSORBENT T.Rama S. Praveen kumar, M.Bala Murugan; S.Samsu Raja	25
26	RACE15/PSR/026	Study On Addition Of The Natural Fibers Into Concrete D.Nandha, R.Arjun, R.Ramasubramaniyan, P. Issac johnson	26

27	RACE15/PSR/027	EXPERIMENTAL INVESTIGATION ON THE BEHAVIOR OF ULTRA HIGH STRENGTH CONCRETE WITH AGRO WASTE Radha Srinivasan	27
28	RACE15/PSR/028	STRENGTH OF STEEL FIBER REINFORCED CONCRETE – AN EXPERIMENTAL STUDY Dr. V.S.Tamilarasan, S.Thivya Devi	28
29	RACE15/PSR/029	Assessment of Seasonal Variation in Rainfall Pattern for Ten Years -A case study of Southern districts in Tamil Nadu S.Preethi, Dr.S.Chandran	29
30	RACE15/PSR/030	STUDY ON CONCRETE USING COPPER SLAG AS A PARTIAL REPLACEMENT OF FINE AGGREGATE Dr.V.S.Tamilarasan, K.Thangaselvi	30
31	Race15/psr/031	Utilization of copper slag based geo polymer concrete P.Saravanan, D.Brindha	31
32	RACE15/PSR/032	STRENGTH STUDY OF M-SAND & FLY ASH BASED GEOPOLYMER CONCRETE K. Arul priya, S.Dharmar	32
33	RACE15/PSR/033	MECHANICAL PROPERTIES OF POLYPROPYLENE FIBER REINFORCED SELF COMPACTING CONCRETE S.Brundha , Dr.B.G Vishnuram	33
34	RACE15/PSR/034	EXPERIMENTAL AND ANALYTICAL STUDY ON FLEXURAL BEHAVIOUR OF GLASS FIBRE REINFORCED CONCRETE BEAMS G.Jayakumar, B.G. Vishnuram,	34
35	RACE15/PSR/035	MECHANICAL PROPERTIES OF SELF – COMPACTING GEOPOLYMER CONCRETE COMPOSITES J.Jeyaseela, B.G.Vishnuram	35
36	RACE15/PSR/036	EXPERIMENTAL STUDY ON STRENGTH PERFORMANCE OF LIGHT-WEIGHT CONCRETE USING CINDER M.Maheswaran, R.Banupriya	36

37	RACE15/PSR/037	EXPERIMENTAL STUDY ON FLEXURAL BEHAVIOR OF FIBER REINFORCED GEOPOLYMER FERROCEMENT FOLDED PANEL C.Manikandan, S.Dharmar	37
38	RACE15/PSR/038	EXPERIMENTAL STUDY ON FLEXURAL BEHAVIOR OF REINFORCED CONCRETE HOLLOW CORE SANDWITHC BEAMS S,Manikandan, S. Dharmar	38
39	RACE15/PSR/039	NUMERICAL SIMULATION OF MICRO MECHANICAL BEHAVIOUR OF ENGINEERED CEMENTITIOUS COMPOSITES S. Manimanju, Saptarshi Sasmal, S. Robert Ravi	39
40	RACE15/PSR/040	EXPERIMENTAL STUDY ON STRENGTH PERFORMANCE OF LIGHT WEIGHT CONCRETE USING LECA B. Muthumari, R.Banupriya	40
41	RACE15/PSR/041	BEHAVIOUR OF ENGINEERED CONCRETE UNDER MONOTONIC AND FATIGUE LOADING C.Nagananthini, Nawal Kishor Banjara, S. Robert ravi	41
42	RACE15/PSR/042	Strength and Durability Aspects of Glass Fiber Reinforced SCC with Manufactured Sand P.Nagaranan, S.Kalirajan, B.G.Vishnuram	42
43	RACE15/PSR/043	EXPERIMENTAL INVESTIGATION ON PHYSICAL AND MECHANICAL PROPERTIES OF SELF COMPACTING CONCRETE WITH CRIMPED STEEL FIBERS Nibin Uthuppan, Kumar P, K. Sudalaimani, S. Robert ravi	43
44	RACE15/PSR/044	FLEXURAL strengthening of RC beams with glass and basalt textile reinforced overlays M.Ponni, Smitha Gopinath, Ramachandra Murthy, S. Robert Ravi	44

45	RACE15/PSR/045	Experimental Study on Fly Ash Based on Self-Compacting Geopolymer Mortar Porkodi.R Dharmar.S	45
46	RACE15/PSR/046	EXPERIMENTAL INVESTIGATION ON STRENGTH CHARACTERESTICS OF HYBRID FIBER REINFORCED SELF COMPACTING CONCRETE M.Rajmari, P. Kumar , K. Sudalaimani, S. Robert ravi	46
47	RACE15/PSR/047	INFLUNCE OF TUBE LENGTH ON BLAST PROTECTION SYSTEM WITH METTALIC TUBE CORE SANDWHICH PANNELS K. Uma maheswari, J. Rajasankar, N.anandavalli, S. Robert ravi	47
48	RACE15/PSR/048	STRUCTURAL BEHAVIOUR OF SELF COMPACTING CONCRETE MADE WITH MANUFACTURED SAND K.Vignesh, S.kalirajan, B.G. Vishnuram	48
49	RACE15/PSR/049	SPECIMEN SIZE EFFECT ON ULTRA HIGH STRENGTH GEOPOLYMER CONCRETE (UHSGC) Vignesh Ganesan, Ambily PS, S. Robert Ravi	49
50	RACE15/PSR/050	EXPERIMENTAL STUDY ON STRENGTH CHARACTERISTICS OF SELF – COMPACTING CONCRETE WITH CRIMPED STEEL FIBER S.Ananthavalli, K.Hemalatha, D,Keerthi, R.Venkateswari, P.Kumar	50
51	RACE15/PSR/050	MECHANICAL BEHAVIOUR OF CONCRETEWITH PARTIAL REPLACEMENT OF CEMENT WITH LIME SLUDGE S.Balasundari, J.Durga, V.Suganya, L.Arun Raja.	51
52	RACE15/PSR/052	EXPERIMENTAL STUDY ON STRENGTH ON PARTIAL REPLACEMENT OF COCKLE SHELL WASTE AS COARSE AGGREGATE G.Jegajothi, R.Ramya, K.Vidhya, M.Suresh	52

45			
46			
47			
48			
49			
50			
51			
52			
53	RACE15/PSR/053	EXPERIMENTSL STUDY ON CURING PERIOD ON STRENGTH OF GEOPOLYMER S.Jemin, B.Kavitha, K.Manju, S.Dharmar	53
54	RACE15/PSR/054	EXPERIMENTAL STUDY ON THE MECHANICAL STRENGTH OF STABLISED MUD BLOCK USING TERMITE MOUND SOIL C.Mangayarkarasi, S.Rajeshwari, K.Surya devi, M.Senthil ram	54
55	RACE15/PSR/055	EXPERIMENTAL STUDY ON EFFECT OF CURING TEMPRATURE ON STRENGTH OF GEOPOLYMER CONCRETE R.UdhyaPriya, C.Vaishnavi, A.Umamaheswari, P.Saranyabanu, S.Dharmar.	55
56	RACE15/PSR/056	INTERPRETIVE STRUCTURAL MODELING FOR TRAFFIC FACTOR ANALYSIS IN MADURAI CITY Nancy Deborah, Yoganandhan.U, Vel Kennedy	56
57	RACE15/PSR/057	DAMAGE DETECTION ON CONCRETE SURFACE USING FLUORESCENT NANOPARTICLES Dr. S.Robert ravi Dr. R.Srinivasan M.Arunbalaji, M.Karuthappandi, V.Vigneshraj, A.Jayaganesh	57
58	RACE15/PSR/058	EXPERIMENTAL STUDY ON MECHANICAL BEHAVIOUR OF LIGHT WEIGHT CONCRETE USING COCONUT SHELL Balamurugan.B, Dharmaraj.S, Vijayan.M, Marikani.P, T.Manikandan	58
59	RACE15/PSR/059	EXPERIMENTAL STUDY ON DURABILITY OF LIGHTWEIGHT CONCRETE R.banupriya, V.Balasubramanian, E.Lingarajadurai, T.Manikandan, K.Sathish Kumar	59
60	RACE15/PSR/060	FLEXURAL BEHAVIOUR OF SELF COMPACTING CONCRETE WITH CRIMPED STEEL FIBRE AND SILICA FUME P.Chandran, R.Deena Dhayalan, S.Manmathadurai, M.Raja, P.Kumar	60

61	RACE15/PSR/061	STUDY ON TRAFFIC SURVEYING AND ANALYSIS ON FOUR POINT JUCTION OF TIRUNELVELI J.Maria Thangaraj, M.Manikandan, R.Kiruba Sankar, G.Mahadevan	61
62	RACE15/PSR/062	STUDY ON TRAFFIC SURVEYING AND ANALYSIS ON FOUR POINT JUCTION OF RAJAPALAYAM T.Anand, M.Mareeswaran, K.Malaichamy, M.Arumugam	62
63	RACE15/PSR/063	INFLUENCE OF MUNCIPAL WASTE COMBUSTION ASH ON STRENGTH OF CONCRETE MR.S.Dharmar, N.Gnanaprakasham , R. Kathish kumaran, R. Mohan, K. Muthukumar	63
64	RACE15/PSR/064	MICROSTRUCTURAL INVESTIGATION OF LIGHTWEIGHT CONCRETE R. Banupriya, S.Kannan , D.Vijaya Mathava Raj, K.Karuppasamy	64
65	RACE15/PSR/065	STUDY ON STRENGTH PARAMETERS OF STABILIZED MUD BLOCK K.Mahendran, Senthil Ram.M Jayasornavel.M, Marimuthu.B, Sankarkumar.S, Sukumar.B	65
66	RACE15/PSR/066	EXPERIMENTAL STUDY ON STRENGTH OF CEMENT CONCRETE WITH M-SAND AND SILICA FUME G.Arunvel, V.S. Kameshwarakumar @ shiva, S.Marimuthu, M.Pandiaraj, K.Prabaharan	66
67	RACE15/PSR/067	STABILISATION OF BLACK COTTON SOIL BY USING PONDASH AND CHARCOAL DUST N.nithya T. Manimaran, G. Shanmugam, W. Paul raj, S. Ramakrishnan	67
68	RACE15/PSR/068	EXPERIMENTAL STUDY ON STRENGTH OF GEOPOLYMER CONCRETE UNDER DAYLIGHT CURING S.Dharmar, S.Karthik Ragunath, D.Manoj, S.Sridhar, V.Vijayakumar, M.Vinothkumar	68
69	RACE15/PSR/069	INVESTIGATION STUDY ON THE USE OF EPOXY RESIN IN SELF HEALING CONCRETE Dr. Robert Ravi S, Dr. Johnson Raja S Nagarajan .S, Rajadurai. K, Uthrakumar. M, Vijay .M	69

61	[illegible]	RACE15/PSR/070	EXPERIMENTAL STUDY ON TREATMENT OF GREY WATER BY USING NATURAL AND CHEMICAL COAGULANTS Mrs. A. Dhanalakshmi, M.E R.Shankarganesh, A.Sirajudeen, C.Sundharraj, S.Vairamuthu	70
62	[illegible]	RACE15/PSR/071	EXPERIMENTAL STUDIES ON CONCRETE BEAMS USING COPPER SLAG AND FIBRE WRAPPING TECHNIQUES BHAVANI.P, Ms.E.VANI	71
63	[illegible]	RACE15/PSR/072	SUSTAINABLE STRATEGY FOR HANDLING SOLID WASTE AT THONUGAL VILLAGE – A CASE STUDY C.Ram Titto, R.K.C Jeykumar	72
64	[illegible]	RACE15/PSR/073	A CASE STUDY ABOUT THE INTER CITY EXPRESS ACCIDENT L.Arun raja A.Ganesh, K.Mahadevan, K.Muthukannan, K.Raj kumar	73
65	[illegible]	RACE15/PSR/073	NECESSITY OF MADURAI - KANYAKUMARI DOUBLE RAILWAY LINE. V.Prabu, S.Prasanth, R.X.RonaldDinesh, K.Venkatesh, L.ArunRaja.	74
66				
67				
68				
69				

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Recent Advancements in Civil Engineering
P.S.R. Engineering College, Sivakasi

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MECHANICAL PROPERTIES OF POLYPROPYLENE FIBER REINFORCED SELF COMPACTING CONCRETE

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ABSTRACT

Self-Compacting concrete is one main type of innovation of concrete and gets compacted by its own weight and without segregation and there is no additional vibration required. The SCC will reduce the construction period, labour and it is cost effective. SCC is a brittle in nature and this will be overcome by adding uniformly distributed fiber in the concrete mix. The cost and demand of natural sand are also increasing day by day; this problem will be solved by replacement of river sand by manufactured sand as fine aggregate. The objective of this study is to determine and comparative study of the properties of SCC containing various proportions of Polypropylene fiber such as 0%, 0.05%, 0.1%, 0.15% volume fraction of the design mix of grades M20 and M30. The influence of polypropylene fiber improved the workability strength and durability properties of self-compacting concrete. This investigation was validated with aid of workability tests of SCC; strength tests were conducted to determine Compressive strength, tensile strength of SCC Mix. Besides, Impact resistance of SCC is also found by conducting laboratory Impact test on SCC disc specimens.

Keywords *— Self-Compacting Concrete; Fly-ash Polypropylene fiber; M-sand; Fresh properties; Mechanical properties*

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EXPERIMENTAL AND ANALYTICAL STUDY ON FLEXURAL BEHAVIOUR OF GLASS FIBRE REINFORCED CONCRETE BEAMS

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ABSTRACT

Concrete is a heterogeneous mixture of cement, aggregate and water. The construction industry calls for advanced design for executing turnkey projects. So, concrete should have high strength and good workability to meet the requirements for such projects. The demand for natural fine aggregate is significantly increased due to rapid development in construction activities. In the present investigation, Flexural Behavior of Glass Fiber Reinforced Concrete beam for M25 and M50 grades of concrete are studied. Manufactured sand is used as Fine aggregate. E-Glass Fiber in varying proportions of 0%, 0.1% and 0.2% by volume of concrete is used. Strength properties such as Compressive strength, Split Tensile, Modulus of Elasticity are determined. Flexural Behavior of GFRC Beam specimens and Conventional Concrete Beam specimens are compared. The first crack load, ultimate load, load versus deflection characteristics, ductility factor and stiffness factor of beams are studied. The analysis part is carried out using ANSYS software. The experimental and analytical results are compared and it was observed that increase in percentage of fiber content to certain extent significantly enhance the strength characteristics, ductility and also reduces the propagation of crack width.

Keywords—ANSYS; Ductility Factor; E-Glass Fiber; Manufactured sand

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Paper ID: RACE

MECHANICAL PROPERTIES OF SELF – COMPACTING GEOPOLYMER CONCRETE COMPOSITES

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ABSTRACT

Self-compacting geopolymer concrete is an innovative and improvedway of concreting
that does not require vibration for placing and it is produced by complete elimination of ordinary
cement by fly ash. Self-compacting geopolymer concrete has two limitations such as delay in setting
heat curing to gain strength. The present research aimed to rectify these two limitations of self-
geopolymer concrete by replacing 20% of fly ash by OPC on mass basis and an attempt to make
manufactured sand instead of using river sand due to scarcity of river sand and depletion of
resources. This paper presents the results of fresh and hardened properties such as Compressive
Split tensile strength, and Impact resistance using M-sand with various proportions of cement.
compacting geopolymer concrete composites containing 80% of fly ash and 20% of cement and
based alkaline liquids for the mix of M20 and M30 grades. In this study, the fundamental requirements
fresh properties are satisfied and the mechanical properties of Self-compacting geopolymer
composites were determined. From the test results, the optimum percentage of replacement of cement
10% for both M20 and M30 grade concrete.

Keywords—Fly ash; Fresh and hardened properties; Geopolymer concrete composites; Self-
concrete; Sodium based alkaline liquids.

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Strength and Durability Aspects of Glass Fiber Reinforced SCC with Manufactured Sand

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ABSTRACT

All over the world researchers are attempting to develop high performance concretes by using fibers and admixtures in concrete up to certain proportions, especially in Self-Compacting Concrete (SCC). Addition of Fiber in SCC combines the benefits of self-compacting in fresh state and shows an improved performance in the hardened state.This paper investigates the study of strength and durability characteristics of Glass Fiber Reinforced Self compacting Concrete (GFRSCC) with varying percentage of fibers. The main aim of this work is to extract the benefits of Glass fiber with SCC and optimum application of Glass fiber for better result in strength and durability characteristics of concrete. The concrete mix used in this study comprises Cement, Manufactured sand, Fly ash, E Glass fiberand water. Additionally Master Glenium SKY 8233 is used as super plasticizer to improve workability with reduced water content and Glenium Stream 2 is used as Viscosity Modifying Agent to enrich flowing ability of fresh concrete. The mix design M30 SCC was arrived as per the Guidelines of European Federation of National Associations Representing for Concrete (EFNARC). To improve ductile property of SCC E Glass fiber strand is added by 0.05, 0.1 and 0.15 % of total volume of concrete. Fly ash (class F) is used here as mineral admixture with 42% replacement of cement content. Slump flow, V-funnel, T5 minutes, L-Box and U-box are the basic testswere conducted to check requirement of SCC with water-powder ratio of 0.35. The strength and durability of harden concrete were tested at the age of 7, 14, 28 and 56 days. The result reveals that addition of Glass fiber in SCCis significant by enhances the strength and durability of GFRSCC.

Keywords: Self-compacting concrete, Glass Fiber, Strength, Durability, Manufactured sand

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STRUCTURAL BEHAVIOUR OF SELF COMPACTING BEAM MADE WITH MANUFACTURED SAND

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ABSTRACT

Self-compacting concrete (SCC) is an innovative concrete that does not require vibration for placing and compaction. It is able to flow under its own weight, completely filling formwork and achieving full compaction, even in the presence of congested reinforcement. Scarcity of good quality Natural River sand (NR sand) due to depletion of resources and restriction due to environmental consideration has made concrete manufactures to look for suitable alternative fine aggregate. One such alternative is "Manufactured sand". In recent years, manufactured sand (M sand) produced by crushing rock deposits is being identified as a suitable alternative source for river sand in concrete and with high volume fly ash the temperature rise of the SCC was 5 to 0% lower than that of the normal concrete (NC), and the setting times of the SCC were 3 to 4 ours longer than those of the control concrete. The mix design proportion for SCC and NC are hown in Table 1. It was also reported that fly ash in SCC helps in improving the strength eyond 28 days.SCC has such tests on green stage such as Slump flow U-Box, L-Box, J-Ring, -Funnel, T_5 were performed on fresh concrete as per EFNARC guidelines. This paper presents e progress of the research on different structural properties like compressive strength, split nsile strength, flexural strength, impact strength and flexural behavior of beam are found in xperimental work and are compared with M30 grade of normal concrete (NC).

eywords: Micro mechanics; Engineered Cementitious Composites; Nonlinear FE simulation; uctility, Strength, Crack propagation.

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NUMERICAL SIMULATION OF MICRO MECHANICAL BEHAVIOUR OF ENGINEERED CEMENTITIOUS COMPOSITES

S. Manimanju[1], Saptarshi Sasmal[2], S. Robert Ravi[3]

ABSTRACT

Concrete is a brittle material that has great compressive strength values but under tension it fails suddenly at much lower loads. To overcome these disadvantages, micro fibers are added into the concrete. The addition of micro fibers into a brittle concrete matrix substantially improves its tensile strength and reduces the tendency of cracking which leads to enhance ductility and toughness. Engineered cementitious composites have been developed exploiting the micro mechanical principles where the properties of individual constituents of heterogeneous composite are considered. Engineered cementitious composites exhibit pseudo strain hardening and multiple cracking in tension. In the present study, numerical model is developed to simulate response parameters of engineered cementitious composites. The model dimension is considered to be 160x40x40mm prism which is subjected to three point bending loading. From the analysis, strength, stiffness, ductility, formation of crack and its propagation are studied where the constituents of the engineered concrete are the parameters. From that result, it is found that engineered cementitious composites show improved strength, ductility and strain hardening behaviour than the conventional ones. The study brought out that there is a huge scope to tailor the properties of the composites at micro level.

Key words: Micro mechanics; Engineered Cementitious Composites; Nonlinear FE simulation; Ductility, Strength, Crack propagation.

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BEHAVIOUR OF ENGINEERED CONCRETE UNDER MONOTONIC AND FATIGUE LOADING

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ABSTRACT

Fatigue is a process of progressive permanent internal changes in the materials that occur under the actions of cyclic loadings. These changes can cause progressive growth of cracks present in the concrete system and eventual failure of structures when high levels of cyclic loads applied for short times or low levels of loads are applied for long times. Fatigue in material occurs when they are subjected to rapidly fluctuating and cyclic stresses. In general, failure of materials occurs due to fatigue at stress levels much lower than yield strength of material for a static load. Many concrete structures such as highway pavements, highway bridges, railroad bridges, airport pavements and bridges, marine structure, etc. are subjected to fatigue loads. Fatigue strength data of concrete and other materials that are used in these structures for obtaining their safe, effective and economical design are needed. It is a common way to compare the fatigue strength obtained from the experiments with the static strength in such a way that the fatigue strength is defined as a part of static strength for a given number of cycles. In this study, first twelve number of prism (100x100x500 mm), six number of cylinders (150x300 mm) and three number of cubes (150x150x150 mm) of plain cement concrete are casted. Compressive strength, Young's modulus and split tensile strength are found to be 45 N/mm^2, 31500 N/mm^2 and 2.87 N/mm^2. Three notched (4x20 mm) prism are tested under monotonic. Average load carrying capacity of the prisms are found to be 6.8 kN. Three load ranges are chosen for fatigue test such as minimum load of 20% of ultimate load is kept constant and maximum load are varied 65%, 75% and 85% of ultimate load. Loading frequency is used as 5 Hz for all fatigue tests. From, the fatigue test, average number of cycles to failure are obtained as 233329, 6133 and 16, respectively. Similar, study on fibre reinforcement concrete is also carried out. Hooked end steel fiber of 65 aspect ratio are used with 0.5% of total weight of concrete with addition of 0.1 % of super plasticizer to make the engineered concrete. The compression and split tensile strength of concrete are found to be 49 N/mm^2 and 3.17 N/mm^2. Further fatigue study on the prism will be carried out.

Keyword: Fatigue, Load range, Number of cycles, Fiber, Engineered concrete.

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FLEXURAL STRENGTHENING OF RC BEAMS WITH GLASS AND BASALT TEXTILE REINFORCED OVERLAYS

M PONNI[1], SMITHA GOPINATH[2], RAMACHANDRA MURTHY[3], S. ROBERT RAVI[4]

ABSTRACT

This paper presents the results of experimental investigations carried out on RC eams strengthened with glass and basalt textile reinforced concrete (TRC) verlays. Both 4 layers and 6 layers of glass and basalt textiles were used as inforcement in the overlay. Ground rubber tire powder incorporated cementitious atrix is used a matrix for embedding the textile reinforcement. Investigations ere carried out on strengthened beams under flexure using four point bending nfiguration using displacement controlled loading rate. The results were amined to determine the enhancement in peak load, ductility and failure pattern.

y Words *- AR Glass, Basal, Textile reinforced concrete; RC beams; Flexure; oundrubbertirepowde*

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EXPERIMENTAL INVESTIGATION ON PHYSICAL AND MECHANICAL PROPERTIES OF SELF COMPACTING CONCRETE WITH CRIMPED STEEL FIBERS

Nibin Uthuppan[1], Kumar P[2*], Dr. K. Sudalaimani[3], Dr.S. Robert ravi[4]

ABSTRACT

Self-compacting concrete (SCC) is a highly-workable concrete that without any vibration or impact and under its own weight fills the formwork, and it also passes easily through small spaces between rebar. In this paper, the effect of crimped steel fibers on rheological properties, compressive strength, splitting tensile strength, flexural strength, and flexural toughness of SCC specimens, using four different steel fiber volume fractions (0.15%, 0.30%, 0.45%, and 0.60%), were investigated. Mix designs with strength of 50 MPa were considered. Rheological properties were determined through slump flow time and diameter, L-box, and V-funnel flow time tests. Mechanical characteristics were obtained through compressive strength and splitting tensile strength tests with standard cylindrical specimens and flexural strength tests were performed by using plain and reinforced concrete beams The results revealed that the workability of SCC will not reduce that have been specified by EFNARC, if we use the crimped steel fiber volume fraction of low aspect ratio, and using high percentages of crimped steel fibers will not led to decrease of other rheological characteristics and compressive strength. Also the splitting tensile strength, flexural strength, and flexural toughness are increased by increasing the percentage of fibers.

Keywords: Self compacting concrete, Rheological properties, Mechanical properties, Crimped steel fibers, Aspect ratio

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EXPERIMENTAL INVESTIGATION ON STRENGTH CHARACTERESTICS OF HYBRID FIBER REINFORCED SELF COMPACTING CONCRETE

M.Rajmari[1], P. Kumar [2], Dr. K. Sudalaimani[3], Dr.S. Robert ravi[4]

ABSTRACT

this experimental study to find the optimum mechanical properties of concrete in Self ompacting Concrete (SCC) with mono fiber and hybrid fiber. The changes of mechanical operties of Self Compacting Concrete specimen used by fly ash, Recron 3s, glass fiber and mbining of two fibers. From these paper two different types of fibers, i.e., recron 3s and glass er were taken in mono and different combinations. The different combinations of fibers 0.25-75%, 0.5-0.5%, 0.75-0.25% and by volume at a maximum fiber volume fraction of 1%. To eck the effect of filling ability and passing ability of SCC, SCC with mono fiber and SCC with brid fiber in different proportion.

ywords—Hybrid fiber, Self compacting concrete, SCC properties.

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Influence of Tube Length on Blast Protection System with Metallic Tube Core Sandwich Panels

K. UMA MAHESWARI[1], J. RAJASANKAR[2], N.ANANDAVALLI[3], S. ROBERT RAVI[4]

ABSTRACT -

Effect of blast loads from explosion can be mitigated by using thick armor systems that are often heavy and significantly affect the self-weight of the structure. In the design of structure for blast protection sacrificial claddings which consist of high energy absorbing elements are used. A sandwich type protective structure consists of light weight core which are often used for blast mitigation. The choice of core type has an influence on the performance of sandwich panel. The cores can be of wood, foam material and tubular elements. In this study, behavior of sandwich panel with square tubular core is investigated through numerical studies. Panel is made of mild steel having top plate dimension of 150 mm x 150 mm x 2.5 mm; bottom plate of 150 mm x 150 mm x 5 mm and square tube core of 12.5 mm x 12.5 mm with 0.6 mm thickness. A finite element model is developed and validated using experimental results available in literature. Parametric studies are also carried out using the validated finite element model. By varying the tube length of the core, the responses of the panels are compared in terms of energy absorption and reaction forces.

Key Words *- Blast; Tube core sandwich panel; Energy absorption; Reaction forces.*

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SPECIMEN SIZE EFFECT ON ULTRA HIGH STRENGTH GEOPOLYMER CONCRETE (UHSGC)

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ABSTRACT

This paper reports an experimental study carried out to investigate the specimen size effect of Ultra High Strength Geopolymer concrete (UHSGC) cubes, cylinder and suggest the equations for the prediction of compressive strength with specimen size. Ambient cured Ultra High Strength Geopolymer concrete mixtures were created by activating industrial by-product materials like Ground granulated blast slag (GGBS) and Silica Fume (SF) by completely excluding Portland cement. Past a decade, vast research has been carried out on Geopolymer concrete. Since the performance of Geopolymer concrete mainly depends upon the quality of the ingredients, packing structure of the concrete mix, rate of Geopolymerisation etc. The reaction mechanism of Portland cement concrete and Geopolymer concrete are completely different. The UHSGC mix is prepared by totally excluding Portland cement by industrial waste materials like GGBS & SF, Standard sand (max 2mm), quartz sand (600μm) and 0.14mm □steel fibres (2% by volume of concrete) of 13mm length having the aspect ratio of 92.5 were used. The compressive strength of ambient cured UHSGC (2% steel fibre) were evaluated. The highest average compressive strength obtained for cubes & cylinder were 143.40 N/mm^2, 75 N/mm^2& 94.55 N/mm^2, 46.61 N/mm^2 with and without steel fibres respectively.

Keywords - Compressive strength; Geopolymer Concrete; grand granulated blast slag; Silica Fume.

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INVESTIGATION STUDY ON THE USE OF EPOXY RESIN IN SELF HEALING CONCRETE

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Nagarajan S[3], Rajadurai K[3], Uthrakumar M[3], Vijay M[3]

ABSTRACT

Concrete is a composite material composed of coarse granular material embedded in a hard matrix of material that fills the space among the aggregate particles and glues them together. Concrete experiences various loading from heavy vehicles, Earthquakes and strong winds. Due to this factor in addition to several more it is inevitable that reinforced concrete eventually develop cracks. When cracks originate in concrete structures, a sequence of serious events begins to occur within those structures. Not only this cracks affect the functionality of the structures, they also affect the durability and strength of the structure. Self Healing Concrete emerges now a day's which has healing agents like Polyurethane, Silica gel, Epoxy Resin which automatically arrest the cracks in the structural elements and it is normally said to be Self Healing. The available self healing agents are Polyurethane, Silica gel, Epoxy Resin. For repairing the type of cracks the healing agents are used. The healing agent is prepared by using ethylene di-amine as a curing agent and poly vinyl alcohol as an emulsifying agent. The resulting chemical is encapsulated and mixing with concrete during casting. After the curing time of concrete, it is subjected to initial loading. This is causing the rupture of capsules. The healing agent is released into the repairing zone. Where it will penetrate into cracks and rebound to mother cement and materials of structure and it will repair damage.

Keyword:
Epoxy Resin, EDA(Ethylene di-amine), Polyvinyl alcohol, Capsulation, Self healing.

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STRENGTH STUDY OF M-SAND & FLY ASH BASED GEOPOLYMER CONCRETE

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ABSTRACT

Concrete is till now the most popular material in construction and one of the most environmentally harmful materials. During the manufacturing of Ordinary Portland cement (OPC), this released a large amount of greenhouse into the atmosphere causing global warming. Geopolymer is such an alternative material which can act as a binder replacing cement. It mainly makes use of waste byproduct substances like fly ash, which is not expensive and will diminish environmental pollution to a large extent. Fly ash is one of the major waste materials available for thermal power plants. Low calcium fly ash is preferred as a source material than high calcium fly ash because of to reducing more CO_2 emissions. River sand is mined from the river beds and sand mining has disastrous environmental consequences. To overcome this tribulation the alternative material required so M-Sand is used as a replacement of river sand. Alkaline liquid (sodium hydroxide, sodium silicate) are used in this project as a binder. It is used in geopolymeriztion process. In this paper the fresh and hardened mechanical properties of geopolymer concrete have been studied and compared with conventional concrete.

Key words—Fly ash; Geopolymer concrete; M-Sand, Mechanical properties

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EXPERIMENTAL STUDY ON FLEXURAL BEHAVIOR OF FIBER REINFORCED GEOPOLYMER FERROCEMENT FOLDED PANEL

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ABSTRACT

Ferrocement is a highly adaptable construction material and acquire high performance characteristics, particularly in cracking, strength, ductility, and impact resistance. The ferrocement reinforcement is uniformly distributed in both direction and closely spaced through the thickness of the section. There is abundant scope for mass production and standardization together with the economy in construction. Ferrocement is appropriate for low-cost roofing, precast units and manhole covers. It is also used for the construction of domes, water tanks, boats, silos and folded plates. Geopolymer is an innovative revolutionary green material. An experimental investigation on ferrocement folded panel with geopolymer mortar and polypropylene fiber has been conducted for various mix proportions and fiber ratio. The results show that the flexural strength of the folded panel increased with the addition of fiber and also concluded that the addition of fibers increased the ductility and decreased the crack development and spilling of cement matrix.

Key Words—Geopolymer Mortar; Ferrocement; Fiber; Folded Panel.

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Experimental Study on Flexural Behaviour of Reinforced Concrete Hollow Core Sandwich Beams

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ABSTRACT

Nowadays research efforts are continuously looking for new, better and efficient construction material and method. We have responsibility to reduce the effect of the application of concrete materials to environmental impact. The concrete should be used as efficiently as much as possible. In this article, we focus on structural material optimization by introducing hollow core using Expanded Polystyrene Foam in tension zone of RC beams. By material optimization, we can reduce the dead loads which contribute to seismic effect in high rise structures. In addition, the hollow core will act as vibration dampers during earthquake and heat insulator. This paper presents details of the studies carried out on flexural behavior of Hollow Core Sandwich RC Beams with different core shapes. The experimental program consists of casting and testing of RC beams of size 1500mmx150mmx200mm with and without hollow core in tension zone. To study the flexural behavior, all beams are tested after 28 days curing by applying loads at 1/3rd points. The performance of Hollow Core Sandwich Beams under flexure shows better when compared with conventional solid beams.

Keywords *— Ductility Factor; Flexural Behaviour; Hollow Core; Optimization; Strain Behaviour*

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EXPERIMENTAL STUDY ON INFLUENCE OF CURING PERIOD ON STRENGTH OF GEOPOLYMER CONCRETE

S.Jemin*, B.Kavitha*,K.Manju*,S.Dharmar**

ABSTRACT

The use of mordern day cement contributes to 14 billion tonnes of Carbon Dioxide (co_2). The production of cement is responsible to produce on ton of co_2 per one ton of cement produced and the cement manufacturing industry is causative to a contribution of 12% of global co_2 emission, which is one of the green house gases that causes climatic due to global warming.

Due to Fly ash's property which has strong Silica Alumina glassy chain, it has been used as supplementary cementing material to substitute Ordinary Portland Cement (opc). It has already been used as pozzolona for a long term with cement due to this pozzolanic property.Strong Alkali Activator is used to break the Silica Alumina chain to enhance the polymeric process of flyash form a cementitous. This process is termed as polymerization by Davidovits.

Geopolymer cement is obtained from the reaction of low calcuim fly ash with the Alkaline Solution such as Sodium Hydroxide and Sodium Silicate the geopolymer cement does not pollute environment .so it is Eco Friendly .Hence the geopolymer concrete has the potential to reduce green house emisssion from the concrete industry by 80%. Also this method can reduce the water scarcity and waste disposal of fly ash . Most of the literature reviews shows that curing period of geopolymer concrete is 24 hrs at 60^0 c . In this study ,geopolymer concrete cubes of size 150X150X150 mm were cast . using geopolymer concrete of M25 garde and are placed for heat curing in a digital controlled heat curing champer at 70^0c for 12hrs,24hrs,36hrs,48hrs,72hrs to assess the optimum curing period and strength. After curing, the cubes are tested in compressive Testing Machine. The results shows that increase in compressive strength with respect to increase in curing period .

Keywords *: Geopolymer, Fly ash, Alkaline Solution, Curing Period ,Curing Temperature.*

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EXPERIMENTAL STUDY ON FLY ASH BASED ON SELF-COMPACTING GEOPOLYMER MORTAR

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ABSTRACT

Geopolymer technology is one of the radical technologies. The main problem of global warming is CO_2 emission, during the cement production. This problem can be minimized by replacing the cement with fly ash. When the cement is used as a binder for the construction, it requires more a amount of water for mixing, curing and the period of curing is also very long. Ferrocement construction is a type of thin reinforced concrete, laminate commonly constructed with hydraulic cement mortar. In thin density reinforced elements, it is difficult to proper compaction. To overcome the above problem, self-compacting geopolymer mortar is introduced. This study was carried out to check the strength properties of self-compacting geopolymer mortar for various mix proportions. Mortar cubes of size 70.6x70.6x70.6 mm are casted and cured at 70°C for 24 hours in the oven. The workability of fresh mortar was determined using slump flow, V-funnel, U-Box, J-Ring, and V-funnel at T5 minutes as per EFNARC guidelines. The results show better performance than conventional cement mortar.

Keywords —Flyash; Self-Compacting Geopolymer Mortar; Sodium Hydroxide; Sodium Silicate; Fiber

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EXPERIMENTAL STUDY ON EFFECT OF CURING TEMPERATURE ON STRENGTH OF GEOPOLYMER CONCRETE

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ABSTRACT

GeoPolymer Concrete (GPC) is a type of amorphous alumino-hydroxide product that exhibits the ideal properties of rock-forming elements such as hardness, chemical stability and longevity. The properties of geo polymer include high early strength, low shrinkage, freeze-thaw resistance, sulphate resistance and corrosion resistance. Considering the increasing demand for developing alternative construction materials, due to the growing environmental concerns, this paper discusses the feasibility of alkali activated geo-polymer concrete binding with fly ash in place of cement as a future construction material. The fly ash reacts with alkaline solution form a gel which binds the fine and coarse aggregates.

The main objective of this study involves observation of structural behaviour of the fly ash based geo-polymer concrete under various temperature condition for 24 hours curing. Concrete Cubes of size 150mmX150mmX150mm using low-calcium fly ash based Geopolymer Concrete of M25 grade were cast to study the effect of various parameters on compressive strength. The ratio of alkaline liquid to fly ash and NaOH to Na_2SiO_3 are 0.5, 2 respectively. Samples are demoulded after 5 days rest period. Then the samples are heat cured at various temperature of 60^0c, 70^0c, 80^0c ,90^0c, 100^0c and 110^0c for 24hrs in hot air oven to assess the optimum curing temperature and strength. After curing, geopolymer concrete cubes were taken to strength test in Compressive Testing Machine. The compressive strength test was conducted on each sample and the results shows there was an increase in compressive strength with respect to increase in temperature. At the same time, density of geopolymer concrete was also checked and the value is around 2400kg/m^3 which is equivalent to that conventional concrete. Hence, geopolymer concrete has a great potential for utilization in construction industry as it is environmental-friendly and also facilitates the use of fly ash, which is a waste product from coal burning industries.

Key words: *GeoPolymer , Fly Ash , Alkaline solution , Heat Curing.*

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INFLUENCE OF MUNCIPAL WASTE COMBUSTION ASH ON STRENGTH OF CONCRETE

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ABSTRACT

The municipal solid waste is occupied large amount of land in the world. In India 366 cities generate municipal solid waste of around 188500 tons per day (TPD) or 68.8 million tons per year (TPY) the past year (1947-2011),the Municipal Solid Waste(MSW) occupied 380sq.km land area in Chennai. Future forecasting (2009-2047) MSW occupy 1400sq.km.Muncipal Solid Waste basically responsible for spreading various kind of diseases. The most common causes for bacillary dysentery , amoebic dysentery and diarrheal disease. Over the past several years, there has been significant controversy concerning the proper management of the residues from combusting municipal solid waste (MSW) and their regulatory classification as hazardous or non-hazardous wastes. Incineration of municipal waste combustion ash has become an important waste disposal because it provides an effective means of reducing the volume of MSW as well as providing an important source of energy. In this paper we made an attempt to use Municipal Waste Combustion (MWC) ash in Civil Engineering. So we collect of MWC ash and tested regional testing laboratory in Madurai. The test result gives the following characteristics present in MWC ash such as SiO_2 and Al_2O_2 (53.21%),silica(30.38%), MgO (4.08%),SO_3(1.59%), Na_2O(1.99%). So, MWC ash is used to produce a geopolymer concrete. Geopolymer is a material resulting from the reaction of a source material that is rich in silica and alumina with alkaline solution. Geopolymer concrete is totally cement free concrete. In geopolymer, fly ash act as binder and alkaline solution act as an activator. Fly ash and alkaline activator undergo geopolymerization process to produce alumino-silicate gel. Due to high calcium and silica content present in the MWC ash, also we can replace partially to cement and sand. In this paper we studied the strength of mortar by partially replacing cement and sand with MWC ash and be result shows better.

Keywords: Geopolymer Concrete, MWC Ash, Alkaline Solution, Sand and Cement Replacement.

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EXPERIMENTAL STUDY ON STRENGTH PERFORMANCE OF LIGHT-WEIGHT CONCRETE USING CINDER

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ABSTRACT

Experimental studies have been carried out to compare the compressive strength, spilt tensile strength, flexural strength, unit weight and workability between lightweight aggregate concrete (LWAC) made with partial replacement of burnt coal cinder by 20%, 40%, 60%, 80% and also full replacement of coarse aggregate with normal weight concrete (NWC). The 28-day compressive strength and the dry concrete density of 0%, 20%, 40%, 60%, 80% varied from 34.6 to 19.29MPa and from 2375 to 1815 kg/m^3. Using the study results, optimized the concrete mix proportion and prepared C_3 60% cinder LWAC with density level 1900kg/m^3 with optimal fly-ash mix concrete for further study of strength behaviour.

Keywords - *Cinder Aggregate; Density; Light-weight concrete; Strength; Structural behaviour.*

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EXPERIMENTAL STUDY ON STRENGTH PERFORMANCE OF LIGHT WEIGHT CONCRETE USING LECA

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ABSTRACT

This study examined the structural behaviour of light-weight concrete (LWAC) made with lightweight aggregates (Light expanded clay aggregates LECA) and normal weight aggregates with the aim to investigate the effect of partial replacement of the normal weight aggregates. The paper concentrated on performance parameters such as compressive strength, splitting tensile strength, flexural strength and unit weight. The LWAC was compared to normal aggregate concrete. The good results obtained for this type of LWAC relative to normal weight concrete, there is no certain mix proportion that can be generally used, as is the case for normal weight concrete, and more studies are still needed to ensure its optimal proportions.

Keywords— *Density; Light Expanded Clay Aggregate (LECA); Light-weight concrete; Strength; Structural behaviour.*

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EXPERIMENTAL STUDY ON DURABILITY OF LIGHTWEIGHT CONCRETE

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ABSTRACT

Lightweight aggregate is a type of coarse aggregate that is used in the production of lightweight concrete products such as concrete block, structural concrete, and pavement. Most lightweight aggregate is produced from materials such as clay, shale, or slate. Blast furnace slag, natural pumice, vermiculite, and perlite can be used as substitutes. To produce lightweight aggregate, the raw material (excluding pumice) is expanded to about twice the original volume of the raw material. The expanded material has properties similar to natural aggregate, but is less dense and therefore yields a lighter concrete product.

Durability can be defined as the ability of material to withstand the effects of its environment. In the building material it may be interpreted as chemical attack, water absorption and carbonation. Chemical attack usually encountered as aggressive groundwater, particularly sulphate, polluted air and spillage of reactive liquids. A chemical aspect of durability is the stability of the material itself, particularly in the presence of moisture.

Concrete made with lightweight aggregate exhibit a higher moisture movement than in the case with normal weight concrete. The durability of lightweight aggregate concrete depends on some factors; they are resistance to freezing and thawing, permeability, resistance to sulfate attack, and Carbonation.

In this project the study about the durability of lightweight concrete to chemical attack will be done by conducting experiments.

Key Words: Lightweight Concrete, Curing, Chemical Attack, Durability

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MICROSTRUCTURAL INVESTIGATION OF LIGHTWEIGHT CONCRETE

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ABSTRACT

The Awareness of lightweight concrete is steadily increasing because of disadvantages and scarcity of raw materials of conventional concrete like environmental hazards and economic considerations. Hence, the inherent internal and external features of lightweight aggregates have been a subject of intense research in recent years. With increasing concern over the excessive exploitation of natural aggregates, synthetic lightweight aggregate produced from environmental waste is a viable new source of structural aggregate material. The uses of structural grade lightweight concrete reduce considerably the self-load of a structure and permit larger precast units to be handled. This study provides new insight into the microstructural and chemical factors which influence the strength properties of structural lightweight aggregate concrete. These are containing various types of lightweight aggregate and proportions of dispersing agents such as water-reducing admixtures and superplasticizers. The microstructural characteristics of the paste-aggregate interface and the paste porosity of these concretes are discussed. The methods used include compressive strength testing, scanning electron microscopy-energy-dispersive X-ray analysis, X-ray diffraction analysis. In this project, the mechanical properties of a structural grade lightweight aggregate made with expanded clay(leca), cinder aggregate will be studied.

KEYWORDS:

Lightweight aggregate concretes, expanded clay, compressive strength, water absorption, microstructure, porosity, paste-aggregate interface.

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FLEXURAL BEHAVIOUR OF SELF COMPACTING CONCRETE WITH CRIMPED STEEL FIBRE AND SILICA FUME

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ABSTRACT

Self-compacting concrete is a highly workable concrete without any vibration and under its own weight fills the formwork it also passes through small spaces between rebar's. when silica fume was used as a cement replacement , it enhanced the effectiveness of added crimped steel fiber on the properties of concrete using different steel fiber volume fraction were investigated in sec. silica fume was introduced at some percentage by weight of cement into the concrete mixtures that were made with water cement ratio. eheological Property were determined through slump flow time and diameter v-funnel flow time test .mechanical characteristics were obtained through compressive strength test with standard cube cylindrical specimen and flexural strength test were performed by using beam the experimental study indicate that the inclusion of crimped steel fiber in silica fume specimen led to the highest long term compressive strength and lowest resistivity furthermore an improvement in the dynamic frequency and decrease in water absorption were attained by adding crimped steel fiber and silica fume specimen.

Key words *– Scc, Crimped Steel Fiber, Silica Fume, Super plasticizer , Flexural Strength*

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EXPERIMENTAL STUDY ON STRENGTH OF GEOPOLYMER CONCRETE UNDER DAYLIGHT CURING

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ABSTRACT

Environmental pollution is the biggest menace to the human race on this planet today. In the construction industry mainly the production of Portland cement will causes the emission of pollutants. Nearly 120 million tone of fly ash get accumulated every year at the thermal power stations in India. In order to reduce the effect of above problems by increasing the usage of industrial by-products in our construction industry. In the present study, Geopolymer concrete is one in which the Portland cement is fully replaced with flyash and alkaline solution are used as binding materials. Generally, geopolymer are adopted in precast construction which requires heat curing. But it is not possible in cast-insitu. Hence Daylight curing is adopted for to overcome these difficulties. The cube specimens are taken of size 150mm x 150mm x 150mm.Two different curings are carried out i.e, curing the geopolymer concrete specimens directly by placing to daylight and the temperature is noted daily. Curing the conventional concrete specimens directly by immersing the specimens into water. The concrete specimens are tested for their compressive strength at the age of 3,7,14,21,28 days and graphical comparison is developed between strength of geopolymer in daylight curing and strength of normal concrete with water curing.

Keywords: *Geo-polymer, fly ash, Alkaline solutions, curing, compressive strength.*

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MECHANICAL BEHAVIOUR OF CONCRETE WITH PARTIAL REPLACEMENT OF CEMENT WITH LIME SLUDGE.

S.Balasundari*, J.Durga*, V.Suganya*, L.Arun Raja**

ABSTRACT

The increased demand of drinking water and power has led huge generation of water treatment plant residue i.e. sludge and the thermal power plant by-product. Large quantities of sludge and fly ash are produced in India and disposed off by landfilling or dumping in and around sites. In this study water softening sludge (lime sludge) has been utilized in concrete. The effect of various combinations on strength has been discussed here.

The paper outlines the composition of the composite material, method of preparation of mortar specimen, testing procedure and salient results thereof. In this research study the cement has been replaced by lime sludge accordingly in the range of 5%, 10% and 15% by weight of M-25 grade concrete.

Concrete mixtures will be produced, tested and compared in terms of compressive strength to the conventional concrete. The tests will be carried out to evaluate the properties for 7, 14 and 28 days. Results will show that the replacement of appropriate lime sludge content able to produce workable concrete with satisfactory strength.Keeping all this view, the aim of the investigation is to study the behaviour of concrete while replacing the lime sludge with different proportions in concrete.

Keywords *: Lime Sludge, Cement, Compressive Strength, Split tensile Strength*

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NECESSITY OF MADURAI - KANYAKUMARI DOUBLE RAILWAY LINE.

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ABSTRACT

The transportation plays an important role in developing country .In modes of transport , Railways plays an important role. Because,it carries large people with minimum expenditure.so,in our country most of the people use Railway network elaborately.Large number of people travelled in Railway,it will meets tremendous development.In the world more number of labours {1.3 crores} working in our Indian Railway only. But, in Railway development doubling of track is necessity for fast reach of track in time for people.In our Tamilnadu, most revenue gained in the route " CHENNAI TO KANYAKUMARI".It covers most of the districts , daily usage of people in the line is more than five {5lakhs},and annual expenditure is nearby {500 crores}.More trains can flow in this region. So,southern Railway provide double track and electrification laid between "CHENNAI-MADURAI" and completed in 2012.Now this project shows remaining secton "MADURAI-KANYAKUMARI"double railway line is necessary or not.

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A CASE STUDY ABOUT INTERCITY EXPRESS ACCIDENT

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ABSTRACT

The project entitled "The Case study about Intercity express " is about the accident of the Intercity express and the factors which were the causes for the accident. In addition to this it gives a detailed study about the people who were responsible for the accident. It also shows the reaction of railway department,the police and the people .

Keywords—ANSYS;accident,railwaydepartment,responsible.

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EXPERIMENTAL STUDY ON TREATMENT OF GREY WATER BY USING NATURAL AND CHEMICAL COAGULANTS

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ABSTRACT

The water scarcity is a major problem in the whole world. The rainfall also gets reduce due to global warming, climate changes and urbanization, rapid growth of industrialization and deforestation. So water scare places lots of bore wells provide by the people. The reason ground water level get too short. So we have a special plan for increase the ground water level by using treated grey water. Turbidity imparts an enormous problem in greywater treatment. In this present study, an attempted has been made to evaluate the effectiveness of locally available tamarind seed powder as natural coagulant for reduction of turbidity in the quality improvement of greywater. It was found that natural coagulant worked better with turbid water. The turbidity reduction efficiency of about 78% was achieved by using tamarind seeds. The coagulation process was used to treat detergent wastewater with ferric chloride as coagulant. Using clay minerals at the dose of 500 mg/L with ferric chloride provided 84% of COD removal efficiency. And also use chemical treatments method adopted for breaking the harmful effect of sulphates, chlorides. And reduce the hardness by using (adding lime or boiling) suitable method. Finally treated water used for domestic use and also some quantity of water used to discharge into the ground by penetration way. So the ground water level increases by our project.

KEYWORDS:

Greywater, Tamarind seeds, Ferric chloride

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EXPERIMENTAL STUDY ON STRENGTH OF PARTIAL REPLACEMENT OF COCKLE SHELL WASTE AS COARSE AGGREGATE

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ABSTRACT

Effort towards preserving natural coarse aggregate for future generation and leaving the waste materials to the environment directly can cause environmental problem. Hence the reuse of waste material has been emphasized. Waste can be used to produce new products so that natural resources are used more efficiently and the environment is protected from waste deposits and reducing cockle shell waste originating from the fisheries industry has initiated studies on possibility of integrating this waste in concrete production. This paper presents the result on the workability and compressive strength of concrete containing various percentage of cockle shell content as partial coarse aggregate replacement. In this research study the coarse aggregate has been replaced by cockle shell accordingly in the range of 0%, 10%, 20% and 30% by weight of M-20 grade concrete. Concrete mixtures will be produced, tested and compared in terms of compressive strength to the conventional concrete. The tests will be carried out to evaluate the properties for 7, 14 and 28 days. Results will show that the replacement of appropriate cockle shell content able to produce workable concrete with satisfactory strength. Keeping all this view, the aim of the investigation is to study the behaviour of concrete while replacing the cockle shell with different proportions in concrete.

Keywords: *cockle shell, partial coarse aggregate replacement, concrete, workability, compressive strength.*

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EXPERIMENTAL STUDY ON THE MECHANICAL STRENGTH OF STABILIZED MUDBLOCK USING TERMITE MOUND SOIL

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ABSTRACT

Adequate shelter for all people is one of the pressing challenges faced by the developing countries. India is currently facing a shortage of about 17.6 million houses. The dream of owning a house particularly for low income families is becoming a difficult reality. Hence it has become a necessity to adopt cost effective innovative and environment friendly housing technologies for the construction of houses and building for enabling the common people to houses at affordable cost. Our project is focused on stabilized mud blocks in the construction of walls. One of the best alternative for construction, of brick masonry wall being cost effective.

Traditional building construction techniques such as adopt burnt bricks suffering from water attack and cracks, thus they need continuously maintain it in order to keep them in good conditions for reducing such problems the alternative construction material such as "stabilized mud blocks" are used for low cost construction techniques.

The termite mound soil were used for making mud blocks stabilized with cement. The properties of clay and termite soil were compared. And also this study evaluated the compressive strength of clay and termite soil bricks stabilised with cement.

This report studies includes the relation between soil properties several stabilizers and their compressive strength and density using local soil taken from the site.

Keywords : Stabilize mud blocks, Termite mound soil, Cement, Compressive Strength

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STUDY ON STRENGTH PARAMETERS OF STABILIZED MUD BLOCK

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ABSTRACT

The paper outlines results of a comprehensive investigation undertaken to assess the influence of soil characteristics and stabilizer content on the physical properties of stabilized soil blocks. Earth as a building material is available everywhere, In developing countries, earth construction is economically the most efficient means to house the greater number of people with the least demand of resources. Methods for the stabilization are compaction and use of admixtures. Lime and Copper slag was commonly used as stabilizer for altering the properties of soils. Traditional earth construction techniques such as adobe brick suffering from water attack and cracks, thus they need continuously maintain it in order to keep them in good condition . Although, stabilized compressed earth blocks as construction materials are highly unknown to most people, its advantages are seen in terms of rescuing the heritage and also as rediscovered environmentally friendly building materials. This is studies the relationships between soil properties, several stabilizer and their compressive strength and density using local soil taken from site at city of Gandhigram in Dindugal.

Keywords: *Stabilized mud block, Compressive strength.*

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EXPERIMENTAL STUDY ON STRENGTH OF CEMENT CONCRETE WITH M-SAND AND SILICA FUME

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ABSTRACT

In India, the conventional concrete is produced using natural sand from river beds as fine aggregate. Decreasing natural resources poses the environmental problem and hence government restriction on sand quarrying resulted in scarcity and significant increase in its cost. This paper present the optimization of replacement of manufactured sand by natural sand with silica fume in Cement Concrete. Concrete mixes were evaluated for compressive strength, flexural strength, and split tensile strength. The Ordinary Portland cement was partially replaced with silica fume by 5%, 10% and 15%. As three proportion and natural sand was fully replaced with manufactured sand. The results indicated that there is an increase in the compressive and flexural strength of concrete nearly 10% to 15% in strength. Addition of up to 15% of silica fume as cement replacement yielded comparable strength with that of the control mix. However, further additions of silica fume caused reduction in the strength. The optimum percentage of replacement of silica fume is up to 15%.

Key words: *M-sand, Silica fume, compressive strength, flexural strength, split tensile strength.*

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STABILISATION OF BLACK COTTON SOIL BY USING PONDASH AND CHARCOAL DUST

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ABSTRACT

As we know road development is one of the major parts growing infrastructure, which is expanding at a very fast rate. With the increasing of population and the reduction of available land, construction of road is of major concern and other civil engineering structures are to be carried out on weak or soft soil. Black cotton soil is one of the major soil deposits in India. Owing to such black cotton soil of poor shear strength and high swelling, shrinkage & slacking will happens when exposed to changes in moisture content. A great diversity of ground improvement techniques of soil stabilization is employed to improve mechanical behavior of soil, thereby enhancing the reliability of road construction. Improvement and stabilization of black cotton soil can be done by using two waste materials like pond ash and charcoal dust. These two components are higher in bonding strength, long life stability. This paper presents the mixing of pond ash and charcoal dust with black cotton soil at various proportions and the test will be carried out for analyzing and identify the improvement of black cotton soil and reduction in road pavement thickness and cost by pond ash and charcoal dust under various tests like specific gravity test, liquid limit test, shrinkage limit test, proctor compaction test, California bearing ratio test.

Key Words: *shear strength, swelling, shrinkage, slacking, pond ash and charcoal dust.*

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EXPERIMENTAL STUDY ON STRENGTH CHARACTERISTICS OF SELF – COMPACTING CONCRETE WITH CRIMPED STEEL FIBER

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ABSTRACT

Self-compacting concrete (SCC) is a highly-workable concrete that without any vibration or impact and under its own weight fills the formwork and it also passes easily through small spaces between rebars .In this effect of steel fiber on rheological properties compressive strength, splitting tensile strength, flexural strength and flexural toughness of SCC specimen using four different steel fiber volume fractions (0.5 %, 1.5%, 2%) were investigate. Two mix design of 40 MPa (medium strength) and 60 MPa (high strength) were considered. Rheological properties were determined through slump flow time and diameter, L-box, V-funnel flow time test. Mechanical characteristics were obtained through compressive strength and splitting tensile strength test with standard cylindrical specimen of 150 x300 mm, and flexural toughness tests were performed by using beam of 100 x 140 x 1200 mm.

The result revealed that the workability of medium and high strength SCC classes is reduced by increasing the steel fiber volume fractions and using high percentage of fiber led to decrease of other rheological characteristics that have been specified by EFNARC and ACI 237R on the contrary splitting tensile strength, flexural strength and flexural toughness are increasing the percentage of fiber; however compressive strength is decreasing by increasing the percentage.

***Key words**: steel fiber, self-compacting concrete*

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DAMAGE DETECTION ON CONCRETE SURFACE USING FLUORESCENT NANOPARTICLES

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ABSTRACT

Concrete is a composite material composed of cement, natural sand and coarse aggregate. When cracks initiate and propagate on the surface of concrete structures, a sequence of serious event begins to occur within those structures. Cracks in concrete not only affect the function of the structure but also affects the strength and stability of the structure. There are some sensitive structures like Concrete Nuclear waste containment, Concrete radioactive waste containment structures, Uranium containment vessel, Concrete dams, Nuclear reactor chamber and Seepage portion on dams. To detect micro cracks on the surface of sensitive structures, periodical inspection should be conducted. In this project we are introducing Fluorescent Nanoparticles such as Lanthanum oxide and Samarium oxide for concrete health inspection. When Applied on the concrete surface, these Nanoparticles occupy the space between the cracks on concrete surface at micro level which are invisible to naked eyes. When the surface is exposed to Ultra Violet light, the fluorescent Nanoparticles get illuminated and the damage can be identified. This technique of damage detection can be used in sensitive structures for health inspection and ensured for safety of the structure and the human society.

Keywords:

Concrete, Cracks, Sensitive Structures, Health Inspection, Fluorescent Nanoparticles, UV light, Illumination.

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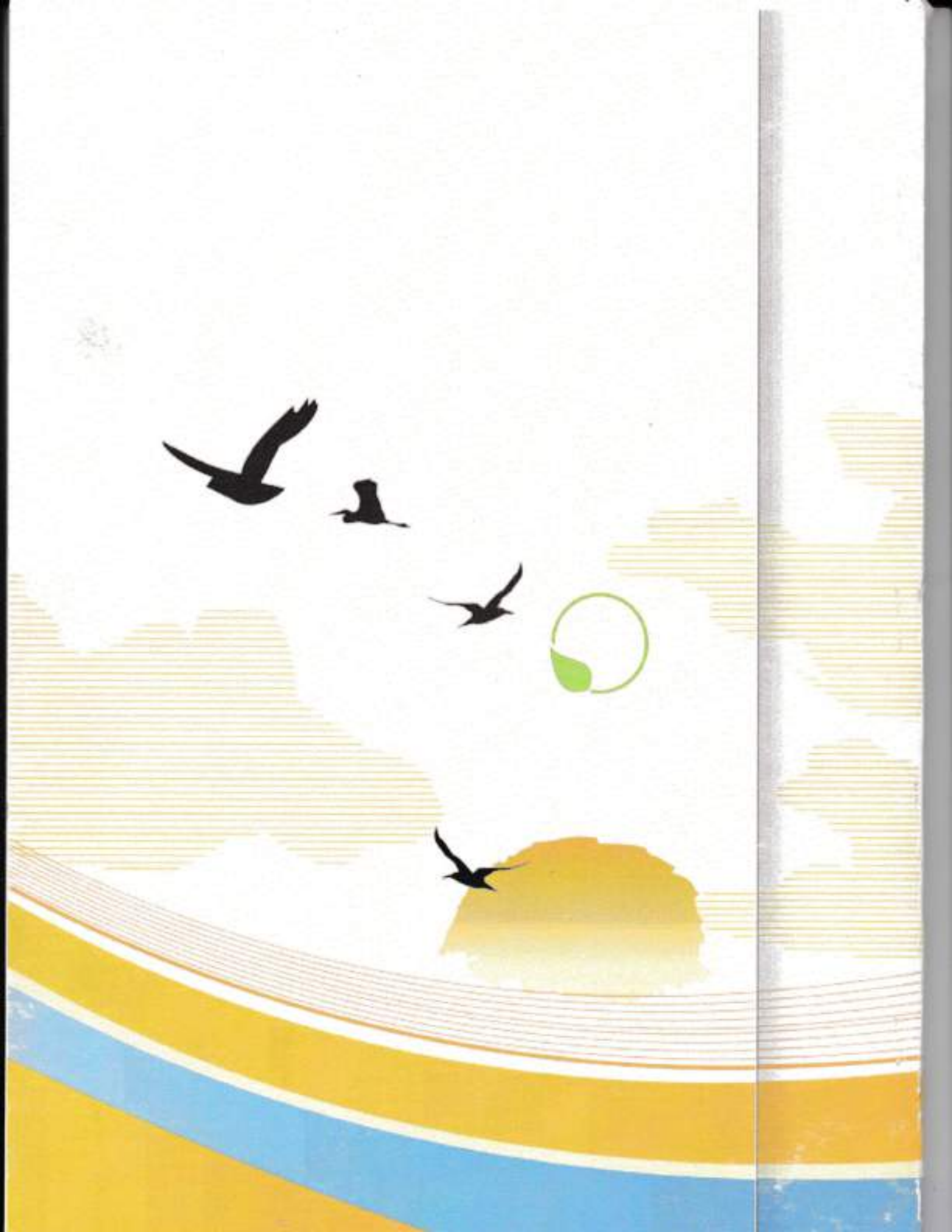

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INDEX

S.No	PAPER DETAILS	Page No.
1.	An Analytical Study of the Use and Application of Web Technologies in the Educational Sector of Mauritius	1
2.	Utilizing Data Science to Develop a Blood Genetics Disease Prediction System	2
3.	Significance Of Integrating Technology With Education In Liberia Schools	3
4.	Educational Technology Based on School Systems of Bhutan	4
5.	Review of Mobile Applications Development Methodologies	5
6.	Gamification: An Effective Tool for Teaching and Learning in the 21st Century	6
7.	Industrial Liquid Waste Management In Khartoum Industrial Area, Sudan Elshafei Mustafa, Osman	7
8.	The Use of Smart Materials in Green Buildings	8
9.	Climate Change in Fiji Islands – A Reality	9
10.	How is the World in the Future When the Us Withdraw from the Paris Agreement on Climate Change	10
11.	Conservation of the Biodiversity of Natural Enemies in Agricultural Farms in Cuba	11
12.	Exploring the Possibility of Using Sludge in production of Biodiesel	12
13.	SocioEconomic Impact of Firewood Energy Consumption in Southern African Households	13
14.	Swot Analysis for Implementing Sustainable Cities in Developing Countries	14
15.	State of Major Tuna Stock (Thunnus Albacares, Katsuwonus Pelamis and Thunnus Obesus) in an Atlantic East-Center Zone (Ivory Coast)	15
16.	Impact of Rangeland Improvements Practices on Sustainable Rangeland Management in Semi-Arid Area Umharoot Area-Sudan	16
17.	The Influence of Climate and Drought on Urban Tree Growth and the Implications for Future Growth Under Climate Change	17
18.	Challenges in Spatial Planning: A Case Study of Bulawayo City, Zimbabwe	18
19.	Gis Based Model for Optimal Location of Dustbins: A Case Study of Uasin Gishu Country	19
20.	Geographical Information System (Gis), A Vital Tool For Sustainable Development In Modern Urbanisation, A Case Of Municipality Of Chinhoyi, Zimbabwe	20
21.	Assessement of Hydro-Meteorological Monitoring Network Stations Using Gis: A Case Study of Cuvelai-Etosha Basin, Namibia	21
22.	Using Gis to Facilitate Visits to Tourist Attractions in the Capital City of Mauritius	22
23.	Implementation of Gis in Urban Local Bodies: A Case Study of Kwekwe City Council, Zimbabwe	23
24.	Hospital Site Selection in Khartoum City in Sudan Using GIS	24
25.	The Using Innovative Technology for Urban Planning And Monitoring	25
26.	Tsunami Impact And Evacuation Strategy Fo Grand Sable Village, Mauritius, Using Remote Sensing And Geographical Information System (GIS)	26
27.	To Control The Home Appliances Using Android Based Raspberry Pi	27
28.	Antioxidant Potential And Phytochemical Screening Of Leucas Aspera	28
29.	The Qualitative Analysis of Phytochemical and Hydroxyl Radical Scavenging Activity on *Cucumis Melo*	29
30.	An Diagnosis of Victims with Vanet Environment using Image Processing Techniques	30
31.	A Contemporarynetwork Security Using Masquerade Ssl In Cluster Of Network	31

32.	K-Means Algorithm For Classifying And Segmenting Of Wbcs In Microscopic Blood Smear Images	32
33.	Forecast Score Based On Public Sentiment Analysis From Textual Reviews	33
34.	ANT Colony Optimization For Solving Job Shop Scheduling Problem	34
35.	Dual server public key encryption with keyword search for secure cloud storage	35
36.	Cloud Workflow Scheduling With Deadlines And Time Slot Availability	36
37.	Image Cloud Processing For Big Data	37
38.	Overview Of Bringing Size-Based Scheduling To Hadoop	38
39.	Application Aware Independent Deduplication For Big Data	39
40.	Classification of Quality using Fundus Images	40
41.	Content-Based Image Retrieval In The Cloud Image Mines	41
42.	Extract facial expressions from mouth region using novel image processing technique	42
43.	Chromosome Classfication Using SVM	43
44.	Smart Manufacturing Using Big Data Analytics: A Case Study In Casting Industries	44
45.	Water Resource Preservation In Agriculture Using Automated Irrigation System	45
46.	Impact of E-Learning on Achievement Of Stutdents In Science at Secondary Level	46
47.	Overview Of Bigdata In Cloud	47
48.	Qos Aware Secure Data Storage And Revocation Mechanism In Cloud Computing	48
49.	Divition and Replication Of Data In Cloud For Optimal Performance And Security	49
50.	Cost-effective privacy preserving of intermediate data sets in Cloud	50
51.	MRI Brain Tumour Segmentation Using Fct Optimization Algorithm	51
52.	Energy Efficient MAC Protocol With Clustered Nodes For M2m Networks	52
53.	Optimized Black Hole Attack Detection Mechnism With Reliable And Secured Routing In Manet Environment	53
54.	Real time healthcare monitoring system using IoT	54
55.	Aadhar based secure public places	55
56.	A Fault Tolerance Technique For Combinational Circuits Using MSR Logic	56
57.	A Hybrid Jaya Algorithm To Solve The Single Machine Scheduling Problems	57
58.	Automatic segmentation and classification of medical images using svm classifier	58
59.	Coupling suppression using latch type sense amplifier in sram	59
60.	Design And Implementation Of Low Power Cmos Dual Edge Triggered Flip-Flops Using Multiple C-Elements	60
61.	Design And Implementation Of Low Power Static Random Access Memory	61
62.	Design And Performance Analysis Of Compact Fractal Antenna For Swb Application	62
63.	Design of Controller for Load Management in Fuel Cell	63
64.	Design Of Fault Tolerant Division Unit Using Reversible Logic For Arithmetic Circuit Using QCA	64
65.	Design Of Microstrip Array Antenna For Wide Band Applications	65
66.	Design of T-latches based on reversible quantum Dot Cellular Automata	66
67.	Design And Implementation Of Mpptcontroller For Grid Connected Photo Voltaic System And Analysing Its Performances	67
68.	Design, Analysis And Implementation Of Ripple Carry Adder Using 8-Bit Full Adder In MGDI Technique	68
69.	Neural Network Classification of Single Channel Eeg Signal Analysis for EPileptic Seizure	69

	Performance Analysis of Time-To-Digital converter Based on Vernier Delay Line	70
	Secure communication using sha 5 in Wireless sensor networks	71
	A Novel Approach for Automatic Microcalcification Detection	72
	A study on work life balance among nurses with special Reference to Sivakasi Taluk	73
	Alumni Data Mart In Academic Erp: The Integration Of Repositories Towards Analytics	74
	Effectiveness Of Visual Merchandising Practices With Reference To Fashion World, Sivakasi	75
	Employees' Opinion Towards Working Environment with Reference to Sree Kannan Silks, Kovilpatti	76
	Properties of Hybrid Fibre Reinforced Polymer Composite	77
	Experimental Investigation Of Animal Bone Powder Replacing Cement In Concrete	78
	Experimental Investigation On Concrete By Using M.Sand And Quarry Dust As Fine Aggregate	79
	Experimental Study On Behavior Of Reactive Powder Concrete Recron 3S Fibers	80
	VLSI Based Color Interpolation For Real Time Video Applications By Using Csa Algorithm	81
	Efficient And Scalable Packet Filter With Finite State Automata	82
	Privacy Preserving Data Mining In Horizontally Distributed Databases	83
	Solar Tracking System For Coin Based Mobile Charger Using Atmel Microcontroller	84
	A Survey Of Appsmodels On Mobicloud Computing	85
	Work-Life Balance Of Software Employees In The Information Technology Industry In Chennai	86
	Electrostriction Effect Of An Aqueous Metformin Hydrochloride With Alanine	87
	Experimental Investigation On Cellular Foam Concrete Folded Panel	88
	Hierarchical Clustering With Best Fit Algorithm For VM Scheduling	89
	Reduction Of Fluoride In Drinking Water Using AzadirachtaIndica (Neem Leaves)	90
	Review On Membrane Bioreactor Technology In Sewage Treatment	91
	The Role Of Information Communication Technologies (Ict) In Education	92
	Security Enhancement In Manet Using Game Theory Approaches	93
	A Novel Approach For Portable ECG Recorder	94
	A Novel Fuzzy Approach For Load Balancing In Cloud Computing	95
	An Efficient Car Parking System Using Reservation In Vanet	96
	Enterprise Resource Planning Success Factors Model: A Structural EquationModelling	97
	Privacy-Protective Multi-Keyword Top-KSimilarity Search Over Encoded Data	98
	Rflicm: Reformulated Fuzzy Local Information C-Mean Image Segmentation	99
	The Sand Replacement In Concrete By Municipal Solid Waste Cum Generated Electricity	100
	Flipping Strategy:An Emerging Megatrend	101
	Identification And Assessment Of Delay Factors In Multi Storey Construction Projects	102
	Modelling And Analytical Studies Of Berthing Structures	103
	Self Compacting Concrete- A Review	104
	Sense Amplifier Half Buffer: A Low Power High Performance Asynchronous Logic QDI Cell Template Using Current Controlled Latch	105
	Storage Auditing And Regenerating Information In Cloud Environment	106
	Study Of Various Decision Tree Algorithms	107
	Training Effectiveness Among Employee's In Dharani Sugars And Chemicals Ltd, Vasudevanallur	108
	Using Balanced Data Distribution Scheme For Energy Hole Avoidance In UWSN	109

110.	Effective Utilization Of Ceramic Waste As A Raw Material In Concrete	110
111.	Employee Satisfaction Leads Increase Productivity In Textile Industries With Special Reference To Loyal Textile Mill Ltd, Kovilpatti	111
112.	Evaluation Of Mechanical Properties Of Natural Fiber Composites	112
113.	Experimental Investigation On Self Curing Concrete Using Pre-Soaked Light Weight Aggregate	113
114.	Ferrocement Box Beam	114
115.	Experimental Study On Bubble Deck Slab Using Geopolymer Concrete	115
116.	Experinmental Investigation Of Cellular Lightweight Concrete	116
117.	Experinmental Investigation Of Foam Concrete Wall Panel	117
118.	Review On Strength Properties Of Self Compacting Concrete By Using Fly Ash And Basalt Fibers	118
119.	Secure Location Determination Services On Mobile Devices	119
120.	Measurement Of Heartbeat Rate Using Video Magnification (VIDMAG)	120
121.	Experimental Study On Self Compacting Concrete With Partial Replacement Of Cement By Flyash	121
122.	Experimental Study On Mechanical Properties Of Recron Fiber Reinforced Self Compacting Concrete	122
123.	Experimental Study On Light Transmitting Concrete	123
124.	Experimental Study On Concrete In Compression Using Coconut Shell And GlassSand	124
125.	Experimental Study On Behaviour Of Concrete By Partial Replacement Of Cement With Glass Powder And Fine Aggregate With Quarry Dust	125
126.	Design Of Standard Cell Asic's Using Sense Amplifier Energy Recovery Flipflop	126
127.	Corporate To Educational Institution - Implementation Of 5S Model	127
128.	Study Of Self Compacting Concrete Using Reactive Powder	128
129.	Study On Flexure Behaviour Of Self Compacting Concrete By Partially Replacing Fine Aggregate With Ferrock	129
130.	Text Based Sentiment Analysis Using Hadoop Mapreduces Framework	130
131.	Analytical Investigation On Concrete Filled Elliptical Steel Tubular Column	131
132.	Utilizing Tailing Sand As Substitute Construction Material In Concrete	132
133.	Adaptive Delay Aware Algorithm For Mobile Data Offloading On Mobile Social Networks	133
134.	Effect Of Strength Properties On Concrete By Partial Replacement Of Fine Aggregate With Aluminium Waste	134
135.	Detection And Resolving Based Low Storage Clone Detection For Secure Data Transmission In Wireless Sensor Network	135
136.	The State Of The Art Analysis On Machining Parameter Optimization Of Metal Matrix Composite	136
137.	Optimal Number And Placement Of Wi-Fi Access Points With Regard To Real Environment Scenario	137

EXPERIMENTAL INVESTIGATION OF ANIMAL BONE POWDER REPLACING CEMENT IN CONCRETE

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In this paper the performance of concrete can be analysed by adding bone powder with cement.Cement is the most important material for the concrete. The production of cement emits enormous amount of CO_2 which pollutes the environment and also the demand of the cemen should also be considered.For reducing the usage of cement, we can use animal bone powder to strengthen the concrete. Animal bone powder is manufactured by the process of calcination and crushing it into powder. It consists of inorganic materials like calcium phosphate, calcium oxide phosphorous pentaoxide and water. In this paper bone powder has been replaced for the cemen for the ratios of 0%,4%,8%,and 12% respectively for M20 Grade concrete under 7 & 28 days o curing.Bone powder is suitable for the construction work, due to the reason of having simila properties of the cement. Animal bone powder has high compressive strength and it can give th greater workability. It is proposed to determine and compare the difference in the conventiona concrete and bone powder concrete. This experimental investigation is carried out using severa tests which include workability test on fresh concrete, specific gravity test, sieve analysis test o fine aggregate, Aggregate Impact test on coarse aggregate and compression test on hardene concrete.

EXPERIMENTAL INVESTIGATION ON CONCRETE BY USING M.SAND AND QUARRY DUST AS FINE AGGREGATE

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Concrete plays a foremost part in the construction industry and a large quantum of concrete is being utilized. River sand is one of the constituent used in the production of conventional concrete, which is obtained from the river beds. Quarrying of river sand in river beds leads to environmental problems such as erosion of river bed and lowering of ground water table level, hence government restriction on sand quarrying resulted in paucity and become more expensive. In view of this, there is a need to recognize suitable alternative material in place of river sand. Thus the locally available and less expensive material of m.sand and quarry dust has been accepted as alternative material for natural sand. The purpose of this study was to investigate the possibility of using m.sand and quarry dust with full replacement of river sand. Design mix of M_{25} grade concrete with fine aggregate replacement of 100%-0%, 75%-25%, 50%-50%, 25%-75%, and 0%-100% of m.sand and quarry dust planned as M1, M2, M3, M4 and M5 respectively. The cube, cylinder, beam are to be casted, cured for the respective mix proportions and the strength characteristics of concrete such as compressive strength, split tensile strength and flexural strength and durability of cube concrete at 58 days and 90 days to be performed. The suitability of m.sand and quarry dust as fine aggregate for concrete has been assessed by comparing its strength and durability properties with that of conventional concrete.

EXPERIMENTAL STUDY ON BEHAVIOR OF REACTIVE POWDER CONCRETE RECRON 3S FIBERS

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In this paper the performance of concrete can be analysed by adding Recronfiber along with Reactive Powder concrete (RPC). Reactive powder concrete is a developing composite material that will allow the concrete industry to optimize material usage to generate economic benefits, and build structures that are strong, durable and sensitive to environment. A comparison of the physical, mechanical and durability properties of RPC (Reactive Powder Concrete) and HPC (High Performance Concrete),shows that RPC possesses better strength (both compressive and flexural) and lower permeability compared to HPC. Thus the main aim of this project study is to develop sustainable concrete development called reactive powder concrete using recronfibers. This experimental investigation is carried out using several tests which include specific gravity test, sieve analysis test on fine aggregate,cement,silicafume,Quartz sand, and compression test on hardened concrete .

REDUCTION OF FLUORIDE IN DRINKING WATER USING AZADIRACHTA INDICA (NEEM LEAVES)

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Fluoride is a persistent and non – biodegradable pollutant that accumulates in soil, plants, wildlife and in a human beings. Therefore, removal of fluoride, using best technique with optimum efficiency is needed. The present survey highlights on efficiency of different materials for the removal of fluoride from water. The study assess the suitability of inexpensive leaf adsorbents to effectively remediate fluoride contaminated water. In present study neem leaves powder activated using chemical treatment as a low cost adsorbent and its characteristics were studied. The most important results of extensive studies on various key factors (Ph, contact time, temperature, particle size, surface area, adsorbent dosage) fluctuate fluoride removal capacity of materials are reviewed. The adsorption equilibrium is well correlated by freundlich and Langmuir models. Langmuir isotherm fits well for defluoridation of water using leaf powder. The percentage of fluoride removal using the low cost adsorbents are as follows, inativarted adsorbent – 91% activated adsorbent = 85%, carbonized adsorbent = 87 %.

REVIEW ON MEMBRANE BIOREACTOR TECHNOLOGY IN SEWAGE TREATMENT

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The conventional process of treating the sewage is through activated sludge process. This process requires more Area. Advent of membrane made the engineers and scientists to use that into the technology which is called as Membrane Bioreactor Technology. By using this technology the process is not only made simpler but also superior in terms of the quality. Moreover the area required for the treatment plant is much lesser because of the technology involved. The scope of the treated sewage application is concerned to other industrial usages like Hydro testing, Cooling purposes etc. In addition the treated sewage is used for the regular use of horticulture, afforestation, gardening etc..

ENTERPRISE RESOURCE PLANNING SUCCESS FACTORS MODEL: A STRUCTURAL EQUATION MODELLING

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Earlier very few research paper deals about critical success factors (CSFs) based Enterprise Resource Planning (ERP) system research on construction industry, those few researches are too only focused the study area on large scaled construction firms in leading nations. But developing nations are mostly facing difference situations. The outcomes of this study delivers ERP system Successful Adoption Model (ERP-SAM) for the benefit of construction companies which are not presently using ERP systems. However, it is found from the study that CSF were followed atsuccessful firms only and not fully followed at unsuccessful firms when implementing ERP systems.

IDENTIFICATION AND ASSESSMENT OF DELAY FACTORS IN MULTI STOREY CONSTRUCTION PROJECTS

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The construction industry in India is an important sector due to its enormous contribution to the country's economic development. Nowadays the construction field is improving rapidly. However due to the geographical, political, social and financial situation of the country, Many construction projects are prone to delay. This delay factor can only be avoided by first identifying the factors and their source.

The main aim of this paper was to find out the main causes of delay in Building construction project in Tamil Nadu. The research design was quantitative, where the data collected from clients, consultant and contractors using questionnaires. The questionnaires had a list of delay causing the factor of which the respondents were ask to rank each according to the 5 point likert scale. The obtaining data are analyzed by using the Statistical Program Social Science (SPSS) T-test and RII method to test delay causes.

A study is analysis and comparing to the most important delay causes in the research. Statistical analysis is carried out using analysis of variance T-test and RII method to test delay causes, Obtain from the survey. The test results reveal good correlation causes while there is significant deference between them for some delay causes and finally building progress for prioritizing delay causes is presented.

MODELLING AND ANALYTICAL STUDIES OF BERTHING STRUCTURES

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Poompuhar coast located south of Chennai bordering bay of Bengal. The coastal stretch has sufficient potential for fishing operations. It is proposed to construct berthing structures for enhancing the facilities for fishing operations. The details of analyses and parametric studies performed are detailed in this report. drawing for the development of Fishing Harbour Main berth at Poompuhar. Berthing structures are subjected to large lateral forces due to berthing and mooring vessels. The lateral forces are to be resisted by the vertical pile, raker pile or diaphragm wall. A berth is a designated location in a port or harbour used for mooring vessels when they are not at sea. Berthing structure is a most important component of harbour. Modeling the rectangular shaped berthing structure with pile foundation. And it is analyzing with help of STAAD Pro.v8i version software. Under the different loading condition .

Behaviour of structure with respect to waves, Modelling of piles and soil parameters and Conclusions on Ultimate bending moment, deflection and soil reaction.

EXPERIMENTAL INVESTIGATION ON SELF CURING CONCRETE USING PRE-SOAKED LIGHT WEIGHT AGGREGATE

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Self curing(SC) refers to the time-dependent improvement of concrete strength due to the gradual release of water from aggregate, in which it was absorbed before mixing, to the cement particle to allow continued hydration. "SCC is defined as a process by which the hydration of cement occurs because of the availability of additional internal water that is not part of the mixing water. "Curing is taken to happen 'from the outside to inside.' Silica fume, also known as micro silica, is a fine-grain, thin, and very high surface area silica. Light weight Aggregate is an aggregate of low density used to produce lightweight masonry. A lightweight inert material, such as foamed slag, vermiculite, and clinker used in concrete for making structures of low weight and high insulation. Vermiculite is a natural mineral that expands with the application of heat. The expansion process is called exfoliation and it is routinely accomplished in purpose-designed commercial furnaces. One such method is self curing. The use of self curing agents can provide a sufficient volume of water by means of light weight aggregate (LWA) to counteract the effects of shrinkage. In addition to the volume of water provided by the LWA, the distribution of the LWA plays an integral role in the effectiveness of self curing. The specimens are cast with replacement of cement with 5% of silica fume and addition of 5%, 10%, 15% LWA like vermiculite. Compressive strength, split tensile strength and flexural strength are the various parameters which is going to be investigated in future.

EXPERIMENTAL STUDY ON BEHAVIOUR OF GEOPOLYMER FERROCEMENT BOX BEAM

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Now a days problems faced by the construction industry is shortage of raw materials. This can be overcome by reducing usage of materials by creating voids in the member. In case of horizontal member (beam), the zone below the neutral axis is provided with steel reinforcement to take tension and the concrete material below the neutral axis is used only to transfer the stress. This sacrificial concrete can be replaced by light weight material like Polystyrene, PVC, Brick, Polypropylene balls etc.

Geopolymer is a new technology for reducing global wrming. It can be used as a full replacement material for cement which is described as eco-friendly material. Box beam is a concept used to reduce the self-weight of the beam, usage of concrete materials and to increase the ductility factor in high rise buildings. Geopolymer box beam of size 150mm*200mm*1500mm has to be casted by introducing Expanded Polysyrene to create voids with a size of 50mm*100mm*1200mm. A comparative study has to be performed on the behaviourof control specimen and geopolymerferrocement box beam.

EXPERIMENTAL STUDY ON BUBBLE DECK SLAB USING GEOPOLYMER CONCRETE

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This paper describes the behavior of Bubble Deck Slab using Geopolymer concrete. Dead oad and ductility are the major concern in the design of high rise buildings in which the walls nd floors will contribute more to the dead load. To reduce the dead load in the structures, major teps have been taken already in wall and floor system by using light weight blocks in walls and ollow core and PT slabs in floors. Bubble Deck slab is the alternate floor system which is in esearch stage to reduce self weight as well as to impart ductility in the structure.

The Bubble Deck slab is an innovative biaxial concrete floor slab system used in onstruction industry. It was invented by JorganBreuning of Denmark about 20 years ago. It is ow gaining popularity both in Europe and in Asia. In this approach Bubble Deck Slab is ntroduced to eliminate superfluous concrete which is not performing any structural function by eans of Polypropylene (PP) plastic balls. Introducing polypropylene plastic balls in Geopolymer oncrete slab is innovative study of decreasing dead weight of structural member and aintaining flexibility over high rise building.

Experimental investigation followed by casting slab specimen of size 1000 mm * 1000 m* 100mm of three slab specimen consist of one control specimen and two Bubble Deck Slab pecimen of varying cross section of Bubbles arrangement as 400 * 400 mm^2 and 600 * 600 m^2. Comparative study involves with control specimen as load versus deflection characteristics y applying five point load on the specimen after curing the specimens in heat curing chamber 75-80 degree for 24 hours. The results will be correlated with analytical study.

EXPERIMENTAL STUDY ON BUBBLE DECK SLAB USING GEOPOLYMER CONCRETE

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EXPERINMENTAL INVESTIGATION OF CELLULAR LIGHTWEIGHT CONCRETE

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This world is changing day by day. Technologies are also changed with time. Technological advancement leads business process in all new different dimensions. Country like India is growing rapidly. Infrastructure Development is in big bane. Development forms and methods are also changed due to change in technology. The new concept for making structures is Cellular Lightweight Concrete. It is a light weight, water resistant, fire- proof, sound proof and environment friendly. The main feature of CLC is light in weight. CLC are made of fly ash, cement, and foaming agent. Since fly ash is being accumulated as waste material in large quantity near thermal power plants and creating serious environmental pollution problems, its utilization as main raw material in the manufacture of foam concrete will not only create ample opportunities for its proper and useful disposal but also help in environmental pollution control to a greater extent in the surrounding areas of power plants. One of the methods of reducing the density of concrete relies on the introduction of stable voids within the hardened cement paste or mortar. The voids can be produced by gas or by air. Because a foaming agent introduces the air, the concrete produced is called CLC.

EXPERINMENTAL INVESTIGATION OF FOAM CONCRETE WALL PANEL

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The development of construction industries provides countless benefits to the society and the people. At present scenario, construction field all around the world is facing a serious problem with price hike of raw materials. So they are very much concern to reduce the consumption of readily available raw materials. It is also important for engineers to develop Eco -friendly material, as environment is getting affected day by day by the increasing construction activities. Usage of foam concrete (FC) is an innovative idea to achieve the requirements. Because of its lightweight, the rate of construction is quick and the installation becomes easy. The benefits of foam concrete are endless, which are lightweight in turn saves foundation cost, high load bearing strength, high durability, easy handling and rapid construction, good in sound absorption, earthquake resistant and so on. The focus of this project is to investigate the Physical, chemical and flexural behavior of foam concrete wall panel by using fly ash and Marble Sludge Powder. Foam concrete is promising material in modern building industry because of simple technology and wide range of properties achieved. Foam concrete can be defined as a type of concrete which includes an expanding agent in that it increases the volume of mixture. Foam concrete having several advantages like low water absorption, high thermal insulation, high fire protection, high sound insulation and eco-friendly to environment.

REVIEW ON STRENGTH PROPERTIES OF SELF COMPACTING CONCRETE BY USING FLY ASH AND BASALT FIBERS

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Self-compacting concrete is a relatively invention in concrete and the addition of fibers to it shows improved strength properties. Several studies have been done on self-compacting concrete with fiber addition. An experimental investigation was carried out to study the performance of concrete with the conclusion of 1%, 2%, 3%, 4% & 5% of basalt fiber along with 25% cement replaced with fly ash. Physical properties were determined through Slump Flow, J-Ring, V-Funnel and L-Box tests. The fundamental properties of concrete like compressive strength, split tensile strength and flexural strength are investigated. The basalt fiber has good bonding and crack resistance property of the fiber. It identifies the various influencing aspects related to the use of fly ash and basalt fiber such replacement level of fly ash, dosage of basalt fiber. In the present investigation the main concentration is focused on strength and durability behavior of self-compacting concrete.

EXPERIMENTAL STUDY ON SELF COMPACTING CONCRETE WITH PARTIAL REPLACEMENT OF CEMENT BY FLYASH

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Self-Compacting Concrete is an innovative concrete that does not require vibration for placing and compaction, EFNARC guidelines of SCC. This paper describes the study of SCC by partial replacement of cement with FLYASH, which is the major byproject from thermal power plant. For experimental study, suitable mix design are made based on EFNARC guidelines and IS code by replacing cement with flyash for different proportions and control cube specimens of standard size are cast. Mix proportion of 1:1.6:2.29 are made and water cement ratio of 0.4 is taken and water reducing agent is used to achieve required workability of SCC. From the test result, we can observe that compressive strength of SCC concrete is 19% higher than the conventional concrete. Hence we can replace cement with flyash to optimal level.

EXPERIMENTAL STUDY ON MECHANICAL PROPERTIES OF RECRON FIBER REINFORCED SELF COMPACTING CONCRETE

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Self-Compacting Concrete (SCC) is one of the most important developments in the building industry. It provides solution to the problems occurring in normal concrete such as inadequate compaction which affects the strength and durability of structures. This study is taken up with the objective to evaluate the performance of self-compacting concrete for M30 grade using Recron fibers and by adding suitable super plasticizer and Viscosity Modifying Agent (VMA). Basic tests for fine aggregate, coarse aggregate, cement, freshly prepared SCC tests such as slump flow test, J-ring, V-funnel, U-box tests were done and checked against the specifications given by EFNARC guidelines. Then mechanical properties such as compressive strength and tensile strength were studied and the results were compared with normal SCC mix.

EXPERIMENTAL STUDY ON LIGHT TRANSMITTING CONCRETE

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Light transmitting concrete is one of the fiber reinforced concrete which is used for aesthetic application by incorporating the optical fibers in concrete. Optical fibres are one which helps for transmission of light through fiber. The end-light type of fiber is used to increase the aesthetic appearance of the concrete. The concept of light transmitting concrete is like a transparent concrete. When it is used in ceiling or side wall, it is exposed to direct sun light which transmit the image but not completely transparent. The investigation is not constrained only with the decorative purpose but the effect of fiber application in the strength aspect is also discussed. When the fibers are arranged in different layers, that increases the load carrying capacity and also the patter can be created to make the concrete decorative. In this project we use various percentage of optical fiber like 3%,4% and 5% respectively. Compressive strength of the concrete is tested for 7 days and 28 days. In order to find the intensity of the light transmitted through the concrete at various spacing of the fibers, light transmittance test is conducted.This type of concrete can be installed at a very low cost and increasing the visual appeal. The application can be used in decorating the interior of a hall or lobby and the ceiling to glow in dark by external lighting source and during day time the concrete glows by the light transmission from natural resource.

EXPERIMENTAL STUDY ON CONCRETE IN COMPRESSION USING COCONUT SHELL AND GLASS SAND

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This project work deals with an Experimental study of concrete in compression using coconut shell and Glass sand.In this project, it have provided the varying proportion of coconut shell as partial replacement of coarse aggregate by maintaining the constant percentages of 5% in concrete and also we have provided the varying proportion of glass sand as partial replacement of fine aggregate by maintaining the constant percentages of 10% in concrete. Finally we have provided the cubes for the optimum percentage of both coconut shell and glass sand as partial replacement of coarse aggregate and fine aggregate respectively. Conventional mix is provided to compare the compressive strength against the coconut shell and glass sand concrete.

EXPERIMENTAL STUDY ON BEHAVIOUR OF CONCRETE BY PARTIAL REPLACEMENT OF CEMENT WITH GLASS POWDER AND FINE AGGREGATE WITH QUARRY DUST

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Cement and sand are the essential materials for making concrete which provide good binding among aggregates and also provide high strength. At the time of manufacturing cement releases high amount of CO2 which affects the environment. The cost of sand is high and availability of sand is less. To overcome these problems the alternative materials are required in construction field. Tons of glass being generated as waste from industries and disposal of glass waste is not eco-friendly. The use of glass powder in concrete production has advantages for improving strength. Due to the scarcity of sand, quarry dust is used as a best alternative. These materials are widely used to reduce the cost of construction as well as improved the strength of construction. The experiment shows the property of concrete containing glass powder as a cement partially replaceable material and quarry dust as a sand partially replaceable material. Mix design has been arrived for M25 grade using IS design for conventional concrete and design mix. Glass powder is replaced with optimum level of 20% and quarry dust was partially replaced as 10%, 20%, 30%, 40%, 50%, 60% with sand. Then tested at the age of 7 and 28 days to study the compressive strength, flexure, split tensile strength and compared with conventional concrete. From the experimental results it was found that replacement of 20% glass powder and 50% quarry dust attains the target strength. The compressive strength is increased about 7.1%, split tensile strength is increased about 15.90% and flexural strength is increased about 19.15% when compared to conventional concrete.

STUDY OF SELF COMPACTING CONCRETE USING REACTIVE POWDER

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Self-compacting concrete is a relatively invention in concrete and the addition of fibers to it shows improved strength properties. Several studies has been done on self-compacting concrete with fiber addition. An experimental investigation was carried out to study the performance of concrete with the inclusion of silica fume and quartz sand is replaced with sand. Physical properties were determined through Slump Flow, J-Ring, V-Funnel and L-Box tests. The fundamental properties of concrete like compressive strength, split tensile strength and flexural strength are investigated. The steel fiber has good ductile property of the concrete. It identifies the various influencing aspects related to the use of quartz sand and steel fiber. In the present investigation the main concentration is focused on strength behavior of self-compacting concrete.

STUDY ON FLEXURE BEHAVIOUR OF SELF COMPACTING CONCRETE BY PARTIALLY REPLACING FINE AGGREGATE WITH FERROCK

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Self-compacting concrete is a relatively invention in concrete and the addition of mineral admixture to it shows improved strength properties. Several studies has been done on self-compacting concrete. An experimental investigation was carried out to study the performance of concrete with the inclusion of partially replacing fine aggregate with ferrock. Fresh properties were determined through Slump Flow, J-Ring, V-Funnel and L-Box tests. The fundamental properties of concrete like compressive strength, split tensile strength and flexural strength are investigated. Waste management is one of the most common and challenging problems in the world. The steel making industry has generated substantial solid waste. Steel slag is a residue obtained in steel making operation. This paper deals with the implementation of Steel slag as an effective replacement for sand. Steel slag, which is considered as the solid waste pollutant, can be used for road construction, clinker raw materials, filling materials, etc. In this work, Steel slag is used as replacement for sand, which is also a major component in concrete mixture. In the present investigation the main concentration is focused on strength behavior of self-compacting concrete.

ANALYTICAL INVESTIGATION ON CONCRETE FILLED ELLIPTICAL STEEL TUBULAR COLUMN

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Concrete filled steel tubular columns have gained immense importance in recent decades due to numerous benefits especially in developed countries like china, Japan, U.S.A, Britain. Experimental programs are expensive, time consuming and limited to small ranges of parameters, therefore it is important to develop an analytical model for Concrete filled elliptical steel tubular members. This research provides an analysis of the interaction between concrete core and steel tube in CFEST columns. For this analysis, ABAQUS software was selected. Using this software Analysis was done by varying the thickness of steel tube, length of the column, grade of concrete and diameter ratios (a/b) and then observe the performance of the CFEST column. Currently there is no design guidance available in any Code of Practice for this elliptical cross section. The main aim of the research presented in this paper is to develop a numerical method to be able to predict the axial compressive behaviour of short concrete-filled elliptical steel tubular columns. The ultimate load carrying capacity and failure modes were obtained from the numerical models and then compared against the experimental results; good agreements were obtained .Finally local buckling of steel tube associated with the concrete infill could be observed.

EFFECTIVE UTILIZATION OF CERAMIC WASTE AS A RAW MATERIAL IN CONCRETE

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This paper ceramic industry is known to generate large amounts calcined Clay wastes each year. So far a huge part is used in landfill. This project work deals with the experimental and study of ceramic waste as a construction material. Further land pollution is prevented as ceramic wastes are utilized as a raw material for concrete preparation. The purpose of adding ceramic waste in concrete preparation is due to high price of coarse aggregate in the industry. In this project we have attempted to replace the ceramic wastes as coarse aggregate in various proportions and compressive strength of the concrete was calculated as well as various properties of the ceramic concrete are studied. The result showed that the strength of concrete mixes containing recycled ceramic waste aggregates are likely when compared to the conventional concrete. This indicates that the recycled ceramic waste has a potentially to be used as coarse aggregates for concrete.

Our Institution

P.S.R. Engineering College, *Sivakasi, was established in the year 1999 by P.S.Ramasamy Telugu Minority Educational and Charitable Trust with an objective of imparting quality technical education to the rural students of Southern Tamil Nadu. The College was conferred with autonomous status in the year 2012 and it is accredited by National Assessment and Accreditation Council (NAAC) and National Board of accreditation (NBA).*

NITTTR chennai

The National Institute of Technical Teachers Training Research (NITTTR), *Chennai was established as an autonomous Institute by the Ministry of Human Resource Development, Government of India in the year 1964 to improve the quality of Technical and Vocational Education and Training (TVET) system in India and in southern region in particular. It is also fosters research in the inter disciplinary area of engineering education and offers consultancy and extension services for the total development of Engineering.*

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MECHANICAL BEHAVIOUR OF SELF COMPACTING REINFORCED CONCRETE BEAMS STRENGTHENED WITH HYBRID FIBER

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ABSTRACT

This study represents comparative experimental study on mechanical behaviour of hybrid fiber under compression and split tensile loading. The cube compressive strength and cylinder split tensile strength of conventional concrete and hybrid fiber reinforced concrete are to be determined in the laboratory. The M35grade of concrete mix and mono filament fiber of length 12mm at volume fraction of 0.0% , 0.5% and straight steel fiber of length 12mm and its diameter 0.3mm at volume of 0.0% , 0.5% and adding a mineral admixture silica flour is used in this research. All the specimens are to be tested for 7days and 28 days. It is proposed to study the compressive strength, split tensile strength , flexural behavior for all specimens with different combinations of fibers.

Keywords : self compacting concrete, hybrid fiber, mechanical strength, flexure strength.

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A REVIEW STUDY ONTHE EFFECT OF GEOTEXTILES ON CBR STRENGTH OF CONCRETE PAVED ROAD WITH SOFT AND HARD SUBGRADE

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ABSTRACT

The economic development of a country is closely related to its road transport infrastructure facilities available. The periodic maintenance of the road is limited due to cost consideration which will disrupt the service and affect the function of the road. Because of heavy rain swelling can take place so that compression and contraction takes place and due to that undulation can take place. To overcome the constraints, geotextiles shall be used in pavements to extend the service life of the pavement which requires less repair and maintenance. By using geotextiles bearing capacity of the soil increases. The present study involving the performance of non woven geotextiles, interfaced between sub grade and base course in the rigid pavement system, is carried out experimentally, utilizing the California Bearing Ratio (CBR) testing arrangement. In order to evaluate the performance of the reinforcement the CBR load- penetration graphs were drawn. The tensile strength of geotextiles and the soil geotextiles interaction are the major factors that influence the improvement of the soil. The geotextile is generally used in conjunction with locally available aggregate, such as crushed stone to develop a structural supporting layer.The most common uses of geotextile are in road construction and soil stabilization.

Key Words- maintenance cost, service life, geotextiles, bearing capacity, California bearing ratio, soil stabilization

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ABSTRACT

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PHYSICAL PROPERTIES OF FOAM CONCRETE USING FLY ASH, MARBLE SLUDGE POWDER,GGBS

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ABSTRACT:

Foam concrete is defined as a light cellular concrete which can be classified as a lightweight concrete having density varies from 400 1800 kg/m^3 with random air-voids created from the mixture of foaming agents in mortar. Foam concrete is recognized for its high Flow ability, low cement content, low aggregate usage, and excellent thermal insulation. Furthermore, the foam concrete is considered as an economical solution in fabrication of large scale lightweight construction materials but due to its low compressive strength it cannot be used as structural members. This review study mainly tends to evaluate the physical properties of materials used for foam concrete i.e cement, fly ash, MSP, GGBS. This study reveals that physical properties of all the above materials are within the limit.

Keywords: Foam concrete, Light weight, Flow ability, physical properties

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CORROSION STUDY ON FOAM CONCRETE

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ABSTRACT:

The development of construction industries provides countless benefits to the society and the people. At present days, construction field all around the world is facing a serious problem with price hike of raw materials. So they are very much concern to reduce the consumption of readily available raw materials. Usage of foam concrete is an innovative idea to achieve the requirements. The benefits of foam concrete are endless which are lightweight in turn saves foundation cost, easy handling and rapid construction, high durability and so on. The focus of this project is to investigate the physical, chemical and durability behaviour and the corrosion study on foam concrete by using fly ash, marble sludge powder, GGBS. Foam concrete having several advantages like low water absorption, high thermal insulation, high fire protection, high sound insulation and eco-friendly environment.

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Experimental Investigation on Self Compacting Concrete Using Polypropylene Fiber

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Abstract—*This Self compacting concrete (SCC) is one of the most important developments in the building industry. It provides solution to the problems occurring in normal concrete such as in adequate compaction which affects the strength of structures. This project is taken up with the objective to evaluate the performance of self compacting concrete for M25grade using polypropylene fiber and by adding suitable super plasticizers and viscosity modifying agent (VMA). Polypropylene fiber with added in various percentage (0.1%, 0.2%and 0.3% by weight of the cement). Basic tests for fine aggregate, coarse aggregate, cement, freshly prepared SCC test such as slump flow test, J-ring test, V-funnel test, U-box test were done and checked against the specifications given by EFNARC guidelines. Then Mechanical properties such as compressive strength, tensile strength and flexural strength were studied and the results were compared with normal SCC mix. The SCC mix the addition of 0.3% polypropylene fiber satisfies the workability limits hardly. Hence further addition of fiber may not satisfy the limits recommended by EFNARC guidelines.*

Keywords—polypropylene fiber; self compacting concrete; strength; workability.

I. INTRODUCTION

Self-compacting concrete (SCC) is a recently developed concept in which the ingredients of the concrete mix are proportioned in such a way that the concrete is compacted by its own weight without any vibration effort assuring complete filling of framework even when access is hindered by narrow gaps between reinforcing bars.

SCC requires a high slump that can easily be achieved by super plasticizer addition to a concrete mixture. To avoid segregation on super plasticizer addition, a simple approach consists of increasing the sand content at the cost of the coarse aggregate content by 4% to 5%. But the reduction in aggregate content results in using a high volume of element which, in turn leads to a higher temperature rise and an increased cost. Chemical admixtures are however expensive and their use may increase the material cost saving in labor cost might offset the increased cost but use the mineral admixtures such as fly ash, furnace slag and micro silica could increase the slump of the concrete mixture without increasing cost.

II. PRELIMINARY TEST ON MATERIALS

A. Testing of cement

1. *Fineness Test of Cement*

Correctly 100grms of cement was weighed and taken in a standard IS sieve no.9 (90 microns).The lumps were broken down and the material was sieved continuously for 15 minutes using sieve shaker. The residue left on the sieve was weighed .This weight does not exceed 5% for ordinary cement. Percentage of residue left on sieve = (weight retained/weight taken) x 100

Result: Percentage of residue left on sieve = 3.45

2. *Consistency Test of Cement*

500 grams of cement was taken and a paste was prepared with 24% quantity of water. After completely filling the mould, shake the mould to expel the air. A standard plunger 10mm diameter and 50mm long was attached and brought down to touch the surface of the paste in the test block and quickly released allowed it to sink to the paste by its own weight. The depth of penetration of plunger was

noted down. The second trail was conducted by 25% of water and the depth of penetration was found out. Similarly number of trials was conducted till the plunger penetrates for a depth of 33 to 35mm from top.

Result: Consistence of given sample of cement = 33 %

B. Testing of Fine Aggregate

1. Sieve analysis of fine aggregate

The sample was brought to air – dried condition before weighing and sieving was achieved after drying at room temperature. The air – dry sample was weighed
Fineness modulus =2.72
Zone conformation = Zone-II

2. Specific Gravity Test of Fine Aggregate

The pycnometer was dried thoroughly and weighed as W_1 gram. 200 gram of fine aggregate was taken in the pycnometer and weighed as W_2 gram. The pycnometer was filled with water up to the top. Then it was shacked well and stirred thoroughly with the glass rod to remove the entrapped air. After the air has been removed the pycnometer was completely filled with water up to the mark. The outside of pycnometer was dried with a clean cloth and it was weighed as W_3 grams. The pycnometer was cleaned thoroughly. The pycnometer was completely filled with water up to the top. Then outside of the pycnometer was dried with a clean cloth and it was weighed as W_4 grams.
Result: Specific Gravity of Fine Aggregate (G) = 2.65

C. Testing of Coarse Aggregate

1. Sieve Analysis of Coarse Aggregate

The sample was brought to air – dried condition before weighing and sieving was achieved after drying at room temperature. The air – dry sample was weighed and achieved successively on the appropriate sieves starting with the largest size sieve.
Result: Fineness modulus =6.16

2. Specific Gravity Test of Coarse Aggregate

The container was dried thoroughly and weighed as W_1 gram. 800 gram of fine aggregate was taken in the container and weighed as W_2 gram. The container was filled with water up to the top. Then it was shacked well and stirred thoroughly with the glass rod to remove the entrapped air. After the air has been removed the container r was completely filled with water up to the mark. The outside of container r was dried with a clean cloth and it was weighed as W_3 grams. The container was cleaned thoroughly. The container was completely filled with water up to the top. Then outside of the container was dried with a clean cloth and it was weighed as W_4 grams.

Result: Specific Gravity of Coarse Aggregate (G) = 2.7

III. Mix Design

The mix design of self-compacting concrete is a trial and error method. Many references available for mix proportioning of SCC. Here we use mix proportioning based on previous investigation strength data using Japanese method and also based EFNARC guidelines. The Japanese method was suggested by Okamura in 1993, after extensive trials in laboratory and at sites. In the Japanese method coarse and fine aggregate contents are initially fixed so that self-compact ability is achieved by adjusting the water/powder ratio and super plasticizer dosage. Strength requirements are assessed from field trials of SCC at a later stage
In this investigation we incorporate the procedures of EFNARC guidelines. These guidelines gives the range for coarse aggregate and fine aggregate content and based on the limit the approximate mix design for M30 grade of concrete is obtained.

Proportion:

Cement = 1 (506.57/506.57)

F.A = 1.78 (901.5/506.57)

C.A = 1.59 (808.97/506.57)

Therefore ratio =1 : 1.78 : 1.59

W/P = 0.35

As per EFNARC guidelines the w/p ratio should be 0.8 to 1.1.Hence w/p arrived ratio is below than as referred in EFNAC code. So the w/p ratio is 0.8

IV. Properties of Fresh Concrete

A concrete mix can only be classified as self-compaction if it has the following characteristics.

1. Filling Ability
2. Passing ability
3. Segregation resistance

Immediately after the mixing the value of Slump flow J-Ring, V-Funnel and L-box tests were determined for finding out passing ability, filling ability and segregation resistance respectively for SCC by the following methods.

1. Slump Flow Test
2. J ring Test
3. V funnel Test
4. L Box Test

Result of Properties Of Fresh SCC

The results obtained from the above tests for normal SCC,SCC with Polypropylene Fibers (0.1%,0.2%,0.3%) are tabulated below with the allowable limits prescribe by EFNARC, Europe Guidelines for Self-Compacting concrete.

Testing Methods	Units	Workability Values			
		SCC	SCC01	SCC2	SCC02
Slump Flow(Dia)	mm	690	685	670	655
Slump Flow(sec)	sec	2	2.2	2.6	3
V-Funnel	sec	6	7	8	11
L-Box	mm	0.84	0.93	0.90	0.95
J-Ring	mm	6	7	7.2	7.5

V. Mechanical Properties of SCC

A. *Split Tensile Test*

Tensile strength is one of the basic and important properties of the concrete. Tensile strength is define as " The resistance of a material to a force tending to tear it apart, measure as the maximum tension the material can withstand without tearing". However the determination of tensile strength of concrete is necessary to determine the load at which the concrete members may crack. The cracking is a form of tension failure.

This test is conducted on cylinder specimens of 30cm length and 15cm diameter. The split tensile strength is calculated by the following formula.

$F_t = 2P/Pi\ dl\ N/mm^2$ (or) MPa

Where Ft=Split Tensile strength

P=maximum load taken by the specimen

D=Diameter of specimen

L=length of specimen

The split tensile test is conducted on two specimens and the average tensile

Strength was calculated for each mix. The results are tabulated below

S.NO	TYPE	SPLIT TENSILE TEST		REMARKS
		7 DAYS	28 DAYS	
1	SCC-C	1.2	2	Conventional SCC
2	$PFSCC_1$	1.5	2.2	SCC with addition of 0.1% PPF
3	$PFSCC_2$	1.7	2.5	SCC with addition of 0.2% PPF
4	$PFSCC_3$	1.8	2.8	SCC with addition of 0.3% PPF

B. *Flexural Strength Test*

Flexure tests are generally used to determine the flexural modulus or flexural strength of a material. A flexure test is more affordable than a tensile test and test results are slightly different. The material is laid horizontally over two points of contact (lower support span) and then a force is applied to the top of the material through either one or two points of contact (upper loading span) until the sample fails. The maximum recorded force is the flexural strength of that particular sample.

The Flexural Strength or modulus of rupture (f_b) is given by

$f_b = pl/bd^2$ (when a > 20.0cm for 15.0cm specimen or > 13.0cm for 10cm specimen)

or

$f_b = 3pa/bd^2$ (when a < 20.0cm but > 17.0 for 15.0cm specimen or < 13.3 cm but > 11.0cm for 10.0cm specimen.)

Where,

a = the distance between the line of fracture and the nearer support, measured on the center line of the tensile side of the specimen

b = width of specimen (cm)

d = failure point depth (cm)

l = supported length (cm)

p = max. Load (kg)

S.NO	TYPE	FLEXURAL TEST 28 DAYS	REMARKS
1	SCC-C	5.6	Conventional SCC
2	$PFSCC_1$	6.15	SCC with addition of 0.1% PPF
3	$PFSCC_2$	6.5	SCC with addition of 0.2% PPF

4	$PFSCC_3$	6.7	SCC with addition of 0.3% PPF

C. Result and discussion

The basic properties of materials were tested and tabulated the results. In this project used two admixtures are super plasticizers and viscosity modifying agent. The fresh concrete tests like L-box, V-funnel, J-Ring and slump flow tests were conducted to find out the workability.

The casted cylinder and prism were tested and then the mechanical Properties were found out, such as split tensile strength and Flexural strength on various self-compacting concrete mixes with polypropylene fibers (0.1%, 0.2%, 0.3%) at 7 and 28 days.

In this project, the test results show that

1. Split tensile strength shows a gradual increased
2. The flexural strength showed a great increase in 28 days test.

Acknowledgment

We reverently thank our Correspondent and Managing Trustee “Thiru.R.SOLAISAMY” to provide us this type of college.

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Experimental Investigation on compressive strength of Self Compacting Concrete Using Polypropylene Fiber

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Abstract—This Self compacting concrete (SCC) is one of the most important developments in the building industry. It provides solution to the problems occurring in normal concrete such as in adequate compaction which affects the strength of structures. This project is taken up with the objective to evaluate the performance of self-compacting concrete for M30grade using polypropylene fiber and by adding suitable super plasticizers and viscosity modifying agent (VMA). Polypropylene fiber with added in various percentage (0.1%, 0.2%and 0.3% by weight of the cement). Basic tests for fine aggregate, coarse aggregate, cement, freshly prepared SCC test such as slump flow test, J-ring test, V-funnel test, U-box test were done and checked against the specifications given by EFNARC guidelines. Then Mechanical properties such as compressive strength was studied and the results were compared with normal SCC mix. The SCC mix the addition of 0.3% polypropylene fiber satisfies the workability limits hardly. Hence further addition of fiber may not satisfy the limits recommended by EFNARC guidelines.

Keywords—polypropylene fiber; self compacting concrete; compressive strength; workability.

I. INTRODUCTION

Self-compacting concrete (SCC) is a recently developed concept in which the ingredients of the concrete mix are proportioned in such a way that the concrete is compacted by its own weight without any vibration effort assuring complete filling of framework even when access is hindered by narrow gaps between reinforcing bars.

SCC requires a high slump that can easily be achieved by super plasticizer addition to a concrete mixture. To avoid segregation on super plasticizer addition, a simple approach consists of increasing the sand content at the cost of the coarse aggregate content by 4% to 5%.

But the reduction in aggregate content results in using a high volume of element which, in turn leads to a higher temperature rise and an increased cost. Chemical admixtures are however expensive and their use may increase the material cost saving in labor cost might offset the increased cost but use the mineral admixtures such as fly ash, furnace slag and micro silica could increase the slump of the concrete mixture without increasing cost.

II. OBJECTIVE

- To study the workability characteristic of SCC With addition of mineral admixtures and polypropylene fiber.
- To ensure compressive strength of FRSCC with compared conventional SCC.

III. PRELIMINARY TEST ON MATERIALS

A. Testing of cement

1. *Fineness Test of Cement*

Correctly 100grms of cement was weighed and taken in a standard IS sieve no.9 (90 microns).The lumps were broken down and the material was sieved continuously for 15 minutes using sieve shaker. The residue left on the sieve was weighed .This weight does not exceed 5% for ordinary cement. Percentage of residue left on sieve = (weight retained/weight taken) x 100

Result: Percentage of residue left on sieve = 3.45

2. *Consistency Test of Cement*

500 grams of cement was taken and a paste was prepared with 24% quantity of water. After completely filling the mould, shake the mould to expel the air. A standard plunger 10mm diameter and 50mm long was attached and brought down to touch the surface of the paste in the test block and quickly released allowed it to sink to the paste by its own weight. The depth of penetration of plunger was noted down. The second trail was conducted by 25% of water and the depth of penetration was found out. Similarly number of trials was conducted till the plunger penetrates for a depth of 33 to 35mm from top.

Result: Consistence of given sample of cement = 33 %

B. Testing of Fine Aggregate

1. Sieve analysis of fine aggregate

The sample was brought to air – dried condition before weighing and sieving was achieved after drying at room temperature. The air – dry sample was weighed
Fineness modulus =2.72
Zone conformation = Zone-II

2. Specific Gravity Test of Fine Aggregate

The pycnometer was dried thoroughly and weighed as W_1 gram. 200 gram of fine aggregate was taken in the pycnometer and weighed as W_2 gram. The pycnometer was filled with water up to the top. Then it was shacked well and stirred thoroughly with the glass rod to remove the entrapped air. After the air has been removed the pycnometer was completely filled with water up to the mark. The outside of pycnometer was dried with a clean cloth and it was weighed as W_3 grams. The pycnometer was cleaned thoroughly. The pycnometer was completely filled with water up to the top. Then outside of the pycnometer was dried with a clean cloth and it was weighed as W_4 grams.
Result: Specific Gravity of Fine Aggregate (G) = 2.65

C. Testing of Coarse Aggregate

1. Sieve Analysis of Coarse Aggregate

The sample was brought to air – dried condition before weighing and sieving was achieved after drying at room temperature. The air – dry sample was weighed and achieved successively on the appropriate sieves starting with the largest size sieve.
Result: Fineness modulus =6.16

2. *Specific Gravity Test of Coarse Aggregate*

The container was dried thoroughly and weighed as W_1 gram. 800 gram of fine aggregate was taken in the container and weighed as W_2 gram. The container was filled with water up to the top. Then it was shacked well and stirred thoroughly with the glass rod to remove the entrapped air. After the air has been removed the container r was completely filled with water up to the mark. The outside of container r was dried with a clean cloth and it was weighed as W_3 grams. The container was cleaned thoroughly. The container was completely filled with water up to the top. Then outside of the container was dried with a clean cloth and it was weighed as W_4 grams.

Result: Specific Gravity of Coarse Aggregate (G) = 2.7

IV. Properities Of Polypropylene Fiber

Type	Polypropylene Fiber
Length	10 mm
Diameter	7.5 µm
Aspect ratio	1333.3

V. Mix Design

The mix design of self-compacting concrete is a trial and error method. Many references available for mix proportioning of SCC. Here we use mix proportioning based on previous investigation strength data using Japanese method and also based EFNARC guidelines. The Japanese method was suggested by Okamura in 1993, after extensive trials in laboratory and at sites. In the Japanese method coarse and fine aggregate contents are initially fixed so that self-compact ability is achieved by adjusting the water/powder ratio and super plasticizer dosage. Strength requirements are assessed from field trials of SCC at a later stage
In this investigation we incorporate the procedures of EFNARC guidelines. These guidelines gives the range for coarse aggregate and fine aggregate content and based on the limit the approximate mix design for M30 grade of concrete is obtained.

Proportion:

Cement = 1 (506.57/506.57)

F.A = 1.78 (901.5/506.57)

C.A = 1.59 (808.97/506.57)

Therefore ratio =1 : 1.78 : 1.59

W/P = 0.35

As per EFNARC guidelines the w/p ratio should be 0.8 to 1.1.Hence w/p arrived ratio is below than as referred in EFNAC code. So the w/p ratio is 0.8

VI. Properties of Fresh Concrete

A concrete mix can only be classified as self-compaction if it has the following characteristics.

1. Filling Ability
2. Passing ability
3. Segregation resistance

Immediately after the mixing the value of Slump flow J-Ring, V-Funnel and L-box tests were determined for finding out passing ability, filling ability and segregation resistance respectively for SCC by the following methods.

1. Slump Flow Test
2. J ring Test
3. V funnel Test
4. L Box Test

Result of Properties Of Fresh SCC

The results obtained from the above tests for normal SCC,SCC with Polypropylene Fibers (0.1%,0.2%,0.3%) are tabulated below with the allowable limits prescribe by EFNARC, Europe Guidelines for Self-Compacting concrete.

Testing Methods	Units	Workability Values			
		SCC	SCC01	SCC2	SCC02
Slump Flow(Dia)	Mm	690	685	670	655
Slump Flow(sec)	Sec	2	2.2	2.6	3
V-Funnel	Sec	6	7	8	11
L-Box	Mm	0.84	0.93	0.90	0.95
J-Ring	Mm	6	7	7.2	7.5

VII. Mechanical Properties of SCC

Compression Test

Compression testing is a very common testing method that is used to establish the compressive force or crush resistance of a material. Compressive strength is the capacity of a material or structure to withstand loads tending to reduce size, as opposed to tensile strength, which withstands loads tending to elongate. In other words, compressive strength resists compression. Compressive strength is often measured on a universal testing machine. The maximum range of this machine is 2000kN. The test was conducted on cube specimen of size 0.15 *0.15 * 0.15m. The compressive strength of cube specimen is calculated by the

Following formula.

$F_c=p/A$ N/mm^2 (or) MPa

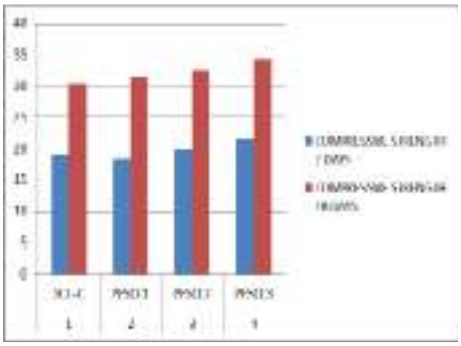
Where Fc=compressive strength

P=maximum load taken by the specimen, A=surface area of specimen

The compression test is conducted on two specimens and average

Compressive strength is calculated for each mix. the results are tabulated below.

S.NO	TYPE	COMPRESSIVE STRENGTH		REMARKS
		7 DAYS	28 DAYS	
1	SCC-C	19	30.5	Conventional self-compacting concrete
2	$PFSCC_1$	18.4	31.5	SCC with addition of 0.1% polypropylene fibers
3	$PFSCC_2$	19.72	32.4	SCC with addition of 0.2% polypropylene fibers
4	$PFSCC_3$	21.7	34.2	SCC with addition of 0.3% polypropylene fibers



A. Result and discussion

The basic properties of materials were tested and tabulated the results. In this project used two admixtures are super plasticizers and viscosity modifying agent. The fresh concrete tests like L-box, V-funnel, J-Ring and slump flow tests were conducted to find out the workability.

The casted cylinder and prism were tested and then the mechanical Properties were found out, such as compressive strength on various self-compacting concrete mixes with polypropylene fibers (0.1%, 0.2%, 0.3%) at 7 and 28 days.

In this project, the test results show that

- Compressive strength shows a gradual increased.

B. Conclusion

The SCC mix the addition of 0.3% Polypropylene fibers satisfies the workability limits hardly. The compressive split tensile and flexural strengths also didn't show a much increase in that 0.4% PFSCC mix. Hence further addition of fibers may not satisfy the limits recommended by EFNARC guidelines and mechanical properties may remain constant or decrease. Polypropylene fibers are nowadays used in self-compacting which is now proved to be enhancing the properties of SCC.

Acknowledgment

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STUDY ON COMPRESSIVE STRENGTH OF SELF COMPACTING CONCRETE USING VARIOUS PROPOTIONS OF STEATITE POWDER

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Abstract- Self compacting concrete is a high-performance concrete which is highly flowable or self-leveling cohesive concrete that can be easily placed in the tight reinforcement. It is also known as super workable concrete. In this experimental study the changes on compressive strength of self-compacting concrete produced by steatite powder were investigated. Self- compacting concrete achieves this by its unique fresh state properties. Steatite powder were used as a replacement for cement. Cement is replaced with steatite powder by 15%, 20%, 25%, and 30%, mass of cement. Ordinary Portland cement of 43 grade is used. The compressive strength properties will be compared with the conventional concrete for curing periods of 7 and 28 days. The grade of concrete used in this project is M30.

Keywords: steatite powder, concrete, compressive strength.

1. INTRODUCTION

Self-consolidating concrete or self-compacting concrete (commonly abbreviated to SCC) is a concrete mix which has a low yield stress, high deformability, good segregation resistance and moderate viscosity. In principle, a self - compacting or self - consolidating concrete must:

1 Have a fluidity that allows self - compaction without external energy.

2 Remain homogeneous in a form during and after the placing process.

3 Flow easily through reinforcement.

Self-compacting concrete (SCC) has little resistance to flow so that it can be placed and compacted under its own weight little or no vibration effort. SCC has viscosity such that segregation and bleeding do not occur. SCC was developed in japan in the late 1980s as solution to achieve durable concrete structures independent of the quality of construction work. SCC usage is also reported to lower the noise level on the construction site and diminish the effect on the environment. Consequently, the use of SCC as a construction material has gradually increased over the last few years. Gradually, is produced using new generation super plasticizers to reduce the water-binder ratio. In addition, supplementary cementations or inert materials such steatite powder are used to increase the viscosity, workability and reduce the cost of SCC.

Compared with conventional concrete of similar mechanical properties, the material cost of SCC is more due to the relatively high demand of Cementation materials and chemical admixtures including high - range water reducing admixtures (HRWRA) and viscosity enhancing admixtures (VEA). Typically, the content in Cementation materials can vary between 450 and 525 Kg/m 3 for SCC targeted for the filling of highly restricted areas and for repair applications.

The SCC essentially eliminates the need for vibration to consolidate the concrete. This results in an increase in productivity, a reduction in noise exposure and a finished product with few if any external blemishes such as “bug holes". However, after completion of proper proportioning, mixing, placing, curing and consolidation, hardened concrete becomes a strong, durable, and practically impermeable building material that requires no maintenance.

2. METHODS AND MATERIAL PROPERTIES

2.1 Methodology:

Mix design of M30 concrete was done with various proportions of steatite powder. The curing was done for 7, 14 and 28 days, after that the hardened tests of compressive, flexural and tensile were made on specimens for the strength test.

2.2 MATERIAL PROPERTIES

2.2.1 Steatite Powder

Steatite is the softest known mineral and listed as 1 on the Mohs hardness scale. The thermal properties of steatite are also good. Lowest apparent porosity is achieved when steatite particles are coarser,

and 40%of polymeric phase is employed. Addition of steatite powder increases the viscosity and mechanical properties of feed stock. The thermal properties of steatite are also good Indian steatite, mined in Rajasthan and Andhra Pradesh, is comparable with the best quality available in other Countries .The chemical properties of steatite powder are listed in Table 2.1.

Table 2.1 Chemical Properties of steatite

SI.NO	Chemical Element	Results (%)
1	Sio_2	44.73
2	Al_2O_3	3.70
3	Fe_2O_3	8.38
4	TiO_2	< 0.001
5	CaO	2.95
6	MgO	29.28
7	Na_2O_2	<0.001
8	K_2O	<0.001
9	MnO	0.13
10	P_2O_5	0.01

3. LITERATURE SURVEY

"Mechanical properties of self -compacting concrete containing silica fume and steatite powder (Padmanapam and N. Sakthieswaren., 2015)"[1], Self-Compacting Concrete which flows under its own weight and homogeneity while completely filling any formwork and passing around congested reinforcement. The experimentation is performed in M30 grade concrete, by nansu method for the volume fractions of Natural Steatite Powder were 0 to 15% by weight of cement content with 1.8% of conplast 430 as super plasticizer in SCC. Many different fresh concrete test methods slump flow, v-funnel and L-box have been developed in attempt to characterize the property of Self-Compacting concrete. The specimens of size 150mm x 150mm cube, 150mm diameter with 300mm height cylinder and 100mm x 100mm x 500mm beam are used. Then the specimen is to tested on 7th and 28th days. The compressive strength, Split Tensile Strength and Flexural Strength are being determined.

"Properties of green concrete containing quarry rock dust and marble sludge powder as fine aggregate. (M. Shahul Hameed and A. S. S. Sekar., 2009)" [2], Green concrete capable for sustainable development is characterized by application of industrial wastes to reduce consumption of natural resources and energy and pollution of the environment. Marble sludge powder can be used as filler and helps to reduce the total voids content in concrete. Natural sand in many parts of the country is not graded properly and has excessive silt on other hand quarry rock dust does not contain silt or organic impurities and can be produced to meet desired gradation and fineness as per requirement. Consequently, this contributes to improve the strength of concrete. Through reaction with the concrete admixture, Marble sludge powder and quarry rock dust improved pozzolanic reaction, micro-aggregate filling, and concrete durability. This paper presents the feasibility of the usage of quarry rock dust and marble sludge powder as hundred percent substitutes for natural sand in concrete. An attempt has been made to durability studies on green concrete compared with the natural sand concrete. It is found that the compressive, split tensile strength and durability studies of concrete made of quarry rock dust are nearly 14 % more than the conventional concrete. The concrete resistance to sulphate attack was enhanced greatly. Application of green concrete is an effective way to reduce environment pollution and improve durability of concrete under severe conditions.

"Behaviour of concrete partially replacement of cement by steatite and polypropylene fiber. (Dr. T. Bhagavathi pushpa and S. Rajesh Kumar., 2016)" [3], The interest in the use of fibers for the reinforcement of composites has increased during the last several years. Use of fibers show considerable improvement in tensile properties of concrete and also reduce shrinkage and cracks. In this study, the results of the Strength properties of concrete, setting time and pozzolanic activity of cement using polypropylene fiber and steatite have been presented. Steatite powder and polypropylene are used as a replacement for cement. Cement is replaced with steatite powder by 30%, 25%, 20%, and 15%, mass of cement and 0.5 % of polypropylene fiber by weight of concrete is constantly added for all mixes. Ordinary Portland cement of 53 grade is used. The strength properties will be compared with the conventional concrete for curing periods of 7, 14 and 28 days. The grade of concrete used in this project is M30.

"Mechanical properties of scc with steatite powder, silica fume and fiber (E. Murugesan ME (structural) and Dr. N. Sakthieswaren Ph.D., 2015)" [3], In this experimental study the changes of some

mechanical properties of self- compacting concrete specimen produced by steatite powder were investigated. Steatite powder can fix the matter by improving ductility and decreasing the total cost of SCC were investigate .Self compacting concrete achieves this by its unique fresh state properties. The main objective is to obtain Self Compacting Concrete which flows under its own weight and homogeneity while completely filling any formwork and passing around congested reinforcement. The Self Compacting Concrete produced by using natural steatite powder. In this experiments the volume fractions taken as 0 to 25% of NSP, 0 to 3% of coir by weight of cement content added.

"Self-compaction high performance green concrete for sustainable development (M. Shahul hameed and A. S. S. Sekar., 2010)" [4], Self-Compacting Concrete (SCC) as the name implies that the concrete requiring a very little or no vibration to fill the form homogeneously. SCC is defined by two primary properties: Ability to flow or deform under its own weight and the ability to remain homogeneous while doing so. A sustainable industrial growth will influence the cement and concrete industry in many respects as the construction industry has environmental impact due to high consumption of energy and other resources. One important issue is the use of environmental-friendly concrete ("green concrete") to enable worldwide infrastructure growth without affecting the environment [1]. The potential environmental benefit to society of being able to build with green concrete is huge. Suitable environmental cost of producing concrete into the current price by adjusting the price of environment resources to elevate concrete's price, which will be helpful for protection of the environment and will promote the advancement of concrete technology. The problems of sustainable development should be considered on the society-economy-technology level. Fresh properties and basic strength characteristics, such as compressive strength, splitting tensile strength, with crusher rock and marble slurry dusts are the main focuses in this research.

"Experimental Methods on Glass Fiber Reinforced Self compacting Concrete (Deepak Raj A, et al IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) ISSN: 2278-1684)" [5], The purpose of this study is to investigate the workability and mechanical properties of plain SCC and GFRSCC. The laboratory testing included slump flow test, L-Box test, sieve segregation resistance test, density test, ultrasonic pulse velocity test, compressive strength test, splitting tensile strength test, and flexural strength test. With reference to the obtained test result we conclude that the addition of glass fibers does not affect the filling ability, passing ability and segregation resistance of the SCC. The glass added is maximum 1% of glass fiber in all sizes.

"Effect of Polypropylene Fibers on Fresh and Hardened Properties of SCC at elevated temperatures (Arabic Nawwaf Saoud AL Qudi, et al., Australian Journal of Basic and Applied Science, 5(10): 378-384,2012)" [6], This research present the result from an experimental study on the optimum amount of Polypropylene (PP) to be used in SCC to prevent spalling when exposed to elevated temperatures. The compressive strength increased, when the polypropylene will be increased up to 10% at elevated temperatures.

"Development of Self Compacting Concrete, Goodier, Nov 2003 (L V A Seshasayi, et al ., 33rd Conference on OUR WORLD IN CONCRETE & STRUCTURES: 25-27 August 2008 Singapore)" [7], This paper outlines a history of SCC from its origins in Japanto the development of the material throughout Europe. Europe are discussed, together with a look at the future for the material in Europe and the rest the world. The history and development of SCC can be divided into two key stages; its initial development I japan in the late 1980s and its subsequent introduction into Europe. SCC was developed from the existing technology used for high workability and underwater concretes where additional cohesiveness is required. The main barrier to the increased use of SCC in the UK and Europe seems to be the lack of experience of process, and the lack of published guidance, codes and specifications.

"Rapid Chloride Permeability Test on Self-Compacting High Performance Green Concrete (M. Shahul Hameed, V.Saraswathi and A.S.S. Sekar.,2011)" [8], Self-compacting concrete (SCC) is one of the most significant advances in concrete technology in the last two decades. SCC was developed to ensure adequate compaction through self-consolidation and facilitate placement of concrete in structures with congested reinforcement and in restricted areas. Marble Sludge Powder (MSP) can be used as filler and helps to reduce the total voids content in concrete. Consequently, this contributes to improve the strength of concrete. An experimental investigation has been carried out to study the combined effect of addition of MSP and crusher rock dust (CRD) on the durability of self-compacting high performance green concrete SCHPGC. This paper aims to focus Chloride Permeability study of (SCHPGC) made with industrial wastes i.e. MSP and CRD from marble processing, and from stone crushing industries. Rapid Chloride Permeability test (RCPT) was conducted to measure thechloride permeability of SCHPGC and the results were compared with the normal concrete made up of river sand (NCRS).

4. EXPERIMENTAL PROGRAM

A. MATERIALS USED

i) Cement

Ordinary Portland cement of 43 grade confirming to IS: 8112-1989 was used for the present experimental investigation. Specific gravity-3.1, Consistency test-31%.

ii) Fine aggregate

Locally available sand passing through 2.36 mm sieve with specific gravity of 2.69 which falls under grading zone II were used for the entire investigation.

iii) Coarse aggregate

Coarse aggregates consist of aggregates larger than fine aggregates and their sizes vary from 10 to 12mm. These tend to improve quality and bond characteristics and generally results in a higher flexural strength of concrete. It also helps in reducing shrinkage. These aggregates occupy 70-80% of volume of the concrete. It is having specific gravity of 2.7 and it is subjected to the sieve analysis the maximum size of large is 150 mm.

iv) Steatite powder

Steatite is a type of metamorphic rock, largely composed of talc ore, rich in magnesium. It is composed of hydrated magnesium silicate: $MgSi_4O_{10}(OH)_2$. Steatite is the softest known mineral and listed as 1 on the Mohr's hardness scale.It is already used in paint industry, particularly in marine paints and protective coatings. This is used in ceramics due to its high resistivity, very low dielectric loss factor, and good mechanical strength. Addition of steatite powder increases the viscosity and mechanical properties of feed stock. The thermal properties of steatite are also good.

v) Super plasticizer

Super plasticizer is essential for the creation of SCC. The job of SP is to impart a high degree of flow ability and deformability, however the high dosages generally associate with SCC can lead to a high degree of segregation. Conplast SP 430 is utilized in this project, which is a product of FOSROC Company having a specific gravity of 1.222. Super plasticizer is a chemical compound used to increase the workability without adding more water i.e. spreads the given water in the concrete throughout the concrete mix resulting to form a uniform mix. SP improves better surface expose of aggregates to the cement gel.

5. DISCUSSION

Compressive strength is most important property of the hardened concrete. The concrete cubes were casted, cured and tested accordance with the IS standard and 7 & 28 days. Compressive strength result of concrete are listed in Table3.1. The highest compressive strength value is 40.8 Mpa which is obtained at 28 days by replacement of 15% of cement by steatite powder by weight of concrete when compared to the conventional mix. Fig 5.1 shows that the compressive strength of concrete
for various mixes.

Table 5.1Compressive Strength

Specimen	7 Days (N/mm2)	28 Days (N/mm2)
CONVENSIONAL	25.1	37.7
S.P (30%)	20.0	26.6
S.P (25%)	21.7	30.1
S.P (20%)	26.1	35.1
S.P (15%)	30.3	40.8

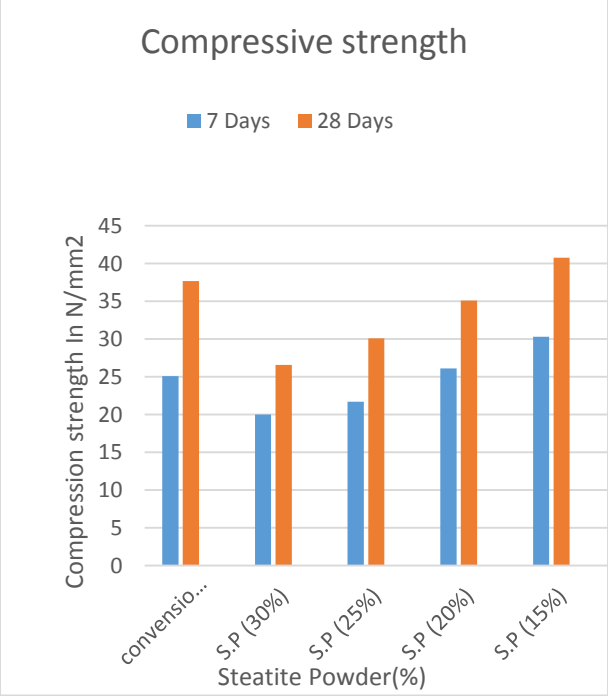

Fig: 4.1.Compressive Strength

From the result, the optimum strength is obtained at replacement of 15% of fine aggregate by steatite powder by weight of concrete. Maximum Compressive strength of cube is found to be 40.8 Mpa at 15% of cement by steatite powder by weight of concrete and it increased by 6.3% than the conventional concrete.

6. CONCLUSION

From the summary of this experimental work the following conclusions were arrived.

- Admixtures affected the workability of SCC Adversely.
- Gradual increase in the compressive strength for M 30 Grade of concrete at 7 and 28 days when 15% partial replacement of natural steatite powder with 1.5% of super plasticizer of SCC compared with conventional SCC.
- The simple method of mix design is greatly reducing the cement material usage and reduces the construction cost.
- The slump value, V-funnel, and L Box value for M30 grade concrete with varying proportions were found out. The values found are identical values.

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Performance of pervious concrete using marble sludge powder

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Abstract— Pervious concrete is one of the most promising sustainable material nowadays. Pervious concrete is the mixture of cement, smaller size coarse aggregate, water and admixture. As cement industry is one of the most polluted industry, so for helps in reducing the pollution. The permeability and strength of pervious concrete depend on the particle sizes and proportions of the constituent materials of which the concrete is made of. In this Experimental study the Behaviour and permeability of pervious concrete made with different coarse aggregate sizes is presented, and to increase the strength of the concrete marble sludge powder is used in the ratio of 0, 0.5,1. For the different aggregate/marble powder ratio used in this study. As the void ratio increase the strength of concrete decrease in order to reduce the voids at the same time without disturbing the permeability marble sludge powder is used in this experimental study.

Keywords—marble sludge powder; pervious concrete; strength; workability.

I. INTRODUCTION

Pervious concrete is a homogeneous mixture of cement, aggregate (fine aggregate and coarse aggregate) and water. Now a days special concrete is more preferred in the construction industry. Some of the special concretes are pervious concrete, transparent concrete, self-compacted and curing concrete because of their special properties which is better compared to conventional concrete. Pervious Concrete is a special type of concrete in which no fine aggregates are used and gravel has been used in place of the coarse aggregate. Pervious Concrete is also called as **"no-fines"** concrete.

Compressive strength and Flexural strength of pervious concrete does depend primarily on the porosity, it is also affected by aggregate / gravel size, shape and gradation. The compressive strength of pervious concrete is in the range of 2.8 MPa to 28MPa. So, pervious concrete cannot be used for structural work but it has so many other applications in which it should be significantly used.

Pervious concrete which is also known as the no-fines, porous, gap-graded, and permeable concrete and enhance porosity concrete has been found to be a reliable storm water management tool (Mary, 2010). By definition, pervious concrete is a mixture of gravel or granite stone, cement, water, little to no sand (fine aggregate) with or without admixtures. When pervious concrete is used for paving (Figure 1), the open cell structures allow storm water to filter through the pavement and into the underlying soils. In other words, pervious concrete helps in protecting the surface of the pavement and its environment.

As stated above, pervious concrete has the same basic constituents as conventional concrete that is, 15% -30% of its volume consists of interconnected void network, which allows water to pass through the concrete. Pervious concrete can allow the passage of 3-5 gallons (0.014 - 0.023m3) of water per minute through its open cells for each square foot (0.0929m2) of surface area which is far greater than most rain occurrences. Apart from being used to eliminate or reduce the need for expensive retention ponds, developers and other private companies are also using it to free up valuable real estate for development, while still providing a paved park. Pervious concrete is also a unique and effective means to address important environmental issues and sustainable growth. When it rains, pervious concrete automatically acts as a drainage system, thereby putting water back where it belongs.

II. PRELIMINARY TEST ON MATERIALS

A. Testing of cement

1. *Fineness Test of Cement*

Correctly 100grms of cement was weighed and taken in a standard IS sieve no.9 (90 microns).The lumps were broken down and the material was sieved continuously for 15 minutes using sieve shaker. The residue left on the sieve was

weighed .This weight does not exceed 5% for ordinary cement. Percentage of residue left on sieve = (weight retained/weight taken) x 100
Result: Percentage of residue left on sieve = 3.45

2. *Consistency Test of Cement*

500 grams of cement was taken and a paste was prepared with 24% quantity of water. After completely filling the mould, shake the mould to expel the air. A standard plunger 10mm diameter and 50mm long was attached and brought down to touch the surface of the paste in the test block and quickly released allowed it to sink to the paste by its own weight. The depth of penetration of plunger was noted down. The second trail was conducted by 25% of water and the depth of penetration was found out. Similarly number of trials was conducted till the plunger penetrates for a depth of 33 to 35mm from top.

Result: Consistence of given sample of cement = 33 %

B. Testing of marble powder

COMPOSITION OF MARBLE POWDER	
Sio_2	25-30
Al_2o_3	0.3-0.5
Fe_2o_3	8-10
Cao	38-45
Mgo	15-18
Specific gravity	2.5
Fines modulus	2.735

C. Testing of Coarse Aggregate

1. Sieve Analysis of Coarse Aggregate

The sample was brought to air – dried condition before weighing and sieving was achieved after drying at room temperature. The air – dry sample was weighed and achieved successively on the appropriate sieves starting with the largest size sieve.
Result: Fineness modulus =6.16

2. *Specific Gravity Test of Coarse Aggregate*

The container was dried thoroughly and weighed as W_1 gram. 800 gram of fine aggregate was taken in the container and weighed as W_2 gram. The container was filled with water up to the top. Then it was shacked well and stirred thoroughly with the glass rod to remove the entrapped air. After the air has been removed the container r was completely filled with water up to the mark. The outside of container r was dried with a clean cloth and it was weighed as W_3 grams. The container was cleaned thoroughly. The container was completely filled with water up to the top. Then outside of the container was dried with a clean cloth and it was weighed as W_4 grams.

Result: Specific Gravity of Coarse Aggregate (G) = 2.7

III. Mix Design

The mix design of pervious concrete is a trial method. Many references available for mix proportioning of pervious concrete. Here we use mix proportioning based on previous investigation strength data using American method and also based ACI guidelines. In the American method coarse and marble powder contents are initially fixed so that pervious concrete ability is achieved by adjusting the water/powder ratio. Permeability requirements are assessed from field trials of pervious concrete at a later stage
In this investigation we incorporate the procedures of ACI guidelines. These guidelines gives the range for coarse aggregate and marble powder content and based on the limit the approximate mix design for M20 grade of concrete is obtained.

Proportion:

Cement = 1

Powder = 0.5

C.A = 4.5

Mix Ratio = 1: 0.5: 4.5

W/C = 0.36

IV. Properties of Pervious Concrete

The pervious concrete mixture is stiff compared to traditional concrete. Slumps, when measured, are generally less than (20 mm), although slumps as high as (50 mm) have been used. However, slump of pervious concrete has no correlation with its workability and hence should not be specified as an acceptance criteria. When placed and compacted, the aggregates are tightly adhered to one another and exhibit the characteristic open matrix that looks like popcorn. In-place densities on the order of 100 lb/ft3 to 125 lb/ft3 (1600 kg/m3 to 2000 kg/m3) are common. Pervious concrete mixtures can develop compressive strengths in the range of 500 psi to 4000 psi (3.5MPa to 28MPa), which is suitable for a wide range of applications. Typical values are about 2500 psi (17MPa). The infiltration rate (permeability) of pervious concrete will vary with aggregate size and density of the mixture, but will fall into the range of 2 to 18 gallons per minute per square foot (80 to 720 liters per minute per square meter).

A moderate porosity pervious concrete pavement system will typically have a permeability of 3.5 gallons per minute per square foot (143 liters per minute per square meter). Converting the units to in./hr. yields 336in./hr. (8534 mm/hr.). Perhaps nowhere in the world would one see such a heavy rainfall. In contrast the steady state infiltration rate of soil ranges from 1 in./hr. (25 mm/hr.) and 0.01 in./hr. (.25 mm/hr). This clearly suggests that unless the pervious concrete is severely clogged up due to possibly poor maintenance it is unlikely that the permeability of pervious concrete is the controlling factor in estimating runoff (if any) from a pervious concrete pavement. For a given rainfall intensity the amount of runoff from a pervious concrete pavement system is controlled by the soil infiltration rate and the amount of water storage available in the pervious concrete and aggregate base (if any) under the pervious concrete.

Generally for a given mixture proportion strength and permeability of pervious concrete are a function of the concrete density. Greater the amount of consolidation higher the strength, and lower the permeability. Since it is not possible to duplicate the in-place consolidation levels in a pervious concrete pavement one has to be cautious in interpreting the properties of pervious concrete specimens prepared in the laboratory. Such specimens may be adequate for quality assurance namely to ensure that the supplied concrete meets specifications. Core testing is recommended for knowing the in-place properties of the pervious concrete pavement. The relationship between the *w*/*cm* and compressive strength of conventional concrete is not significant. A high *w*/*cm* can result in the paste flowing from the aggregate and filling the void structure. A low *w*/*cm* can result in reduced adhesion between aggregate particles and placement problems. Flexural
strength in pervious concretes generally ranges between about 150 psi (1MPa) and 550 psi (3.8 MPa).

V. Mechanical Properties of SCC

A. *Compressive Test*

Compressive strength is one of the basic and important properties of the concrete. **compression strength** is the capacity of a material or structure to withstand loads tending to reduce size, as opposed to tensile strength, which withstands loads tending to elongate. In other words, compressive strength resists compression (being pushed together)

This test is conducted on cube specimens of 15cm length and 15cm breadth. The compressive strength is calculated by the following formula.

Compressive Strength= P/A (N/mm2)

Where, P = Failure Load (N)

A = Cross Sectional Area (mm2)

The compressive test is conducted on two specimens and the average tensile
Strength was calculated for each mix. The results are tabulated below

size of gravel (mm)	Ratio	7 days (N/mm^2)	28 days (N/mm^2)
10	1:1:3.5	9.24	11.53
10	1:0.5:4	7.87	10.1
12.5+10	1:1:3.5	10.74	13.55
12.5+10	1:0.5:4	7.98	11.44
12.5	1:1:3.5	8.79	11.78
12.5	1:0.5:4	6.98	9.66

B. *FlexureTest*

Flexural strength, also known as **modulus of rupture**, or **bend strength**, or **transverse rupture strength** is a material property, defined as the stress in a material just before it yields in a flexure

Flexural Strength of Beam = M / Z (N/mm2)

Where, M = (P * 10160) * L / 4

Z = B * D2 / 6

P = Failure Load (N)

L = Length of beam (mm)

D = Diameter of beam (mm)

B = Width of beam (mm)

size of gravel (mm)	Ratio	7 days (N/mm2)	28 days (N/mm2)
10	1:1:3.5	2.91	3.03
10	1:0.5:4	1.65	1.89
12.5+10	1:1:3.5	2.97	3.02
12.5+10	1:0.5:4	2.67	2.75
12.5	1:1:3.5	157	1.82
12.5	1:0.5:4	1.75	2.05

C. *Result and discussion*

The basic properties of materials were tested and tabulated the results. In this project used marble powder. The pervious concrete tests like Compressive and flexure test

The casted cylinder is tested and then the mechanical Properties were found out, such as compressive and flexure on various pervious concrete mixes with marble powder (0, 0.5, 1) at 7 and 28 days.

In this project, the test results show that

1. Compressive and flexure strength shows a gradual increased

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An Experimental Investigation On Mechanical Properties Of Scc Using Steel Scrap

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Abstract- *This project presents the experimental study on self-compacting concrete (SCC) with replacement of cement by various percentage of fly ash. The main objective is to be determine the flexural strength, compressive & split tensile on Self compacting concrete by partial replacement of cement by fly ash (20%,25%,30%)&steel scraps. The work involves making several types of SCC mixes. For each mix preparation, twenty one cubic specimens, twenty one cylinder specimens and twenty one beam specimens are cast and cured. The specimens are cured in water for 7 days & 28 days. The slump cone, L-BOX,J-RING and V-FUNNEL test are carried out on fresh SCC. The hardened concrete properties such as compressive strength, Split tensile strength and Flexural strength are determined. The result show that SCC with various percentage of fly ash (20%,25%,30%),steel scraps & super plasticizer is mixed with optimum SCC. After each mix preparation, specimens are casted and cured for 28 days in water and compressive strength values are determined.*

Keywords: steel scrap, fly ash, compressive strength, flexural strength, split tensile strength

I. INTRODUCTION

Now a day's Concrete is the most widely used construction material which has several desirable properties like high compressive strength and durability under usual environmental factors. At the same time concrete is weak in tension. Plain concrete has two deficiencies, low tensile strength and a low strain at fracture. Hence reinforcements are necessary. Normally reinforcement consists of continuous deformed steel bars or pre-stressing tendons. Many of the current applications of self-compacting concrete using steel scraps by volume of concrete. By experimental investigations on steel scraps in concrete improve several properties like tensile strength, cracking resistance, impact and wear resistance, ductility and fatigue resistance. The built concrete structures in highly polluted urban and industrial areas, harmful sub-soil water in coastal area and many other hostile conditions are found to be non-durable. One of the main reasons for deterioration of concrete is that too much emphasis is placed on concrete compressive strength and less consideration in durability aspects. It is now recognized that strength of concrete alone is not sufficient, also the environmental condition to which concrete is exposed over its entire life is equally important. Hence strength and durability aspects of concrete are the important factors to be considered for enhanced performance in life time of structure

II. LITERATURE SURVEY

"Analysis of Effect of Addition of Lathe Scrap on the Mechanical Properties of Concrete"[1],Poorva Haldkar and Ashwini Salunke .The effect of addition of lathe scrap on the mechanical properties of concrete. In this paper, M30 concrete is used and lathe scrap fiber is added up to 2% by weight, at a gap of 0.4% (i.e. 0%, 0.4%, 0.8%, 1.2%, 1.6%, 2%). In this investigation, a comparison have been made between plain cement concrete and the fiber reinforced concrete containing lathe scrap (steel scrap)in various proportions by weight. The fiber used is irregular in shape and with varying aspect ratio. The workability of fresh lathe fiber reinforced concrete (LFRC) is restricted to less lathe contents. Analytical comparison is being done between the compressive strength, tensile strength and flexural strength of plain cement concrete and LFRC. The 28 days strength of LFRC for compressive strength, tensile strength and flexural strength, is found to be

increased when compared with the 28 days strength of plain cement concrete.

"Study on the properties of high strength concrete using glass powder and lathe scrap" [2], T. Sezhiyan, R.Rajkumar They have aimed to use glass powder as a replacement of cement to assess the pozzolonic activity of fine glass powder in concrete and study the properties of concrete. Lathe scraps are the waste materials which are collected from workshops and other steel industries at very minimum cost. Scraps considered in this work are 0.5mm thick. 30% concentration of glass powder replacement in concrete is found to be the optimum dosage for their project work.

"Study of utilization of waste lathe scrap on increasing compressive strength and tensile strength of concrete" [3], Irwan lie keng Wong In this research method, they have mixed the lathe waste in three proportions, i.e. 0.5, 1 and 2%. The results show that the compressive strength increased by 16.4% and tensile strength increased by 25.3% due to addition of waste lathe by 2% as compared to plain cement concrete.

"Reuse of steel scrap from lathe machine as reinforce material to enhance properties of concrete" [4], Shirule Pravin, Swami Suman, Nilesh Chincholkar In this study, a comparison has been made between plain cement concrete and steel scrap (i.e. 0.5%, 1%, 1.5%, 2%) by weight of cement has been taken into account. Compressive strength, tensile strength and flexural strength of SSFRC is found to be maximum for volume fraction of 1.5% steel scrap fiber.

"Impact and energy absorption characteristics of lathe scrap reinforced concrete" [5], G. Vijayakumar, P. Senthilnathan, K Panduangan, G Ramakrishna In this research paper, the addition of lathe scrap in concrete has increased the performance of beams in flexural by 40% as compared to PCC. There is only considerable increase in split tensile strength of concrete with lathe scarp as compared with PCC. The result shows that addition of lathe scraps into PCC mixture enhance its compressive strength while it decreases the workability of fresh concrete containing the lathe scrap. The impact strength of concrete mixed with lathe scrap shows increased impact strength as compared with PCC.

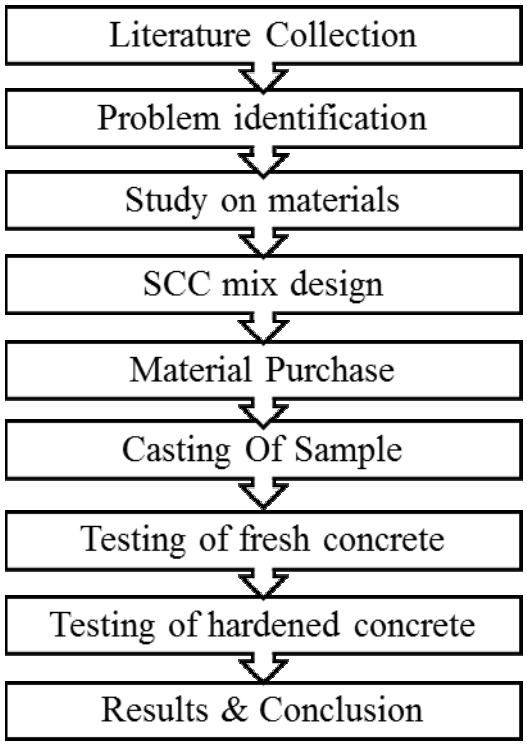
"Experimental study on steel fiber reinforced concrete for M40 Grade" [6], A.M Shende, A.M Pande, M. Gulfam Pathan In this paper, authors observed that compressive strength, split tensile strength and flexural strength are on higher side for 3% fibers as compared to that produced from 0%, 1% and 2% fibers. All the strength properties are observed to be on higher side for aspect ratio of 50 as compared to those for aspect ratio 60 and 67.It is observed that compressive strength increases from 11 to 24% with addition of steel fibers. It is observed that flexural strength increases from 12 to 49% with addition of steel fibers .It is observed that split tensile strength increases from 3 to 41% with addition of steel fibers.

"Properties of green concrete containing quarry rock dust and marble sludge powder as fine aggregate[7] (M. Shahul Hameed and A. S. S. Sekar., 2009)", Green concrete capable for sustainable development is characterized by application of industrial wastes to reduce consumption of natural resources and energy and pollution of the environment. Marble sludge powder can be used as filler and helps to reduce the total voids content in concrete. Natural sand in many parts of the country is not graded properly and has excessive silt on other hand quarry rock dust does not contain silt or organic impurities and can be produced to meet desired gradation and fineness as per requirement. Consequently, this contributes to improve the strength of concrete. Through reaction with the concrete admixture, Marble sludge powder and quarry rock dust improved pozzolanic reaction, micro-aggregate filling, and concrete durability. This paper presents the feasibility of the usage of quarry rock dust and marble sludge powder as hundred percent substitutes for natural sand in concrete. An attempt has been made to durability studies on green concrete compared with the natural sand concrete. It is found that the compressive, split tensile strength and durability studies of concrete made of quarry rock dust are nearly 14 % more than the conventional concrete. The concrete resistance to sulphate attack was enhanced greatly. Application of green concrete is an effective way to reduce environment pollution and improve durability of concrete under severe conditions.

"Self-Compacting Concrete Using Marble Sludge Powder and Crushed Rock Dust [8], M. Shahul Hameed and A. S. S. Sekar., Self Compacting Concrete (SCC) has had a remarkable impact on the concrete construction industry, especially the precast concrete industry. Crushed Rock Dust (CRD) and Marble Sludge Powder (MSP) are discarded in the nearby land and thenatural fertility of the soil is spoiled. MSP and CRD can be used as filler and helps to reduce the total voids content in concrete.Consequently, this contributes to improve the strength of concrete. An experimental investigation has been carried out to study the combined effect of addition of MSP and CRD on the strength and durability of SCC. The study on physical, chemical and mechanical properties such as compressive strength and split tensile strength and the durability tests include water absorption test, water permeability, rapid chloride permeability; electrical resistivity and half cell potential are carried out in this study.From the results it is confirmed that compressive strength increases with increase in percentage replacement of MSP up to 15% of CRD in place of FA. It is found that split tensile strength is directly proportional to the compressive strength. The highest electrical resistivity values were obtained for

Normal Concrete with 100% CRD and significant increase in resistivity values for SCC.

III.METHODOLOGY



IV. EXPERIMENTAL PROGRAMME

4.1. Concrete Mix Design

In the present study M30 grade concrete mix design as per IS: 10262-2009 is carried out. The concrete mix proportion was1:1.91:1.72:0.38 and water content was 178 l/m3

Table 1: Concrete Mix

S.NO	Items	Per m3 of concrete
1	Cement	378.12 kg
2	Fly ash	92.32 kg
3	Fine Aggregate	898.3 kg
4	Coarse Aggregate	809.5 kg
5	Water	178 L

4.2. Casting and Testing

Total 24 cubes, 24 prism and 24 cylinders were casted. Fly ash was added in concrete in 3 different percentages starting from 20% at a gap of 5% up to 30%. For each percent of Fly ash addition, 3 cubes, 3 prism and 3 cylinders were casted. Final compressive strength of cubes was tested after 7, 28 days curing. Flexural strength of beams were tested after 28 days curing and split tensile strength was tested for cylinders after 28 days curing. Compression testing machine is used for determining the compressive strength and split tensile strength of concrete and Flexural Testing machine was used to determine the flexural strength of concrete. The crushing loads were noted and average strengths for three specimens tested were determined for each percentage of Fly ash added (i.e.20%, 25%, 30%).

A.Compressive Strength Test

For compressive strength test, cube specimens of dimensions 150 x 150 x 150 mm were cast for M30 grade of concrete. Super-plasticizer (1.5% by weight of cement) was added to this. The moulds were filled with 20%,25%, 30% fly ash. Vibration was given to the moulds using table vibrator. The top surface of the specimen was levelled and finished. After 24 hours the specimens were demoulded and were transferred to curing tank where in they were allowed to cure for 7 days, 28 days . After 7, 28 days curing, these cubes were tested on compression testing machine as per I.S. 516-1959. The failure load was noted. In each category three cubes were tested and their average value is reported. The compressive strength was calculated as follows. Compressive strength (MPa) = Failure load / cross sectional area.

Fig 1.Compression Test

B. Flexural Strength Test

For flexural strength test prism specimens of dimension 100x100x500 mm were cast. The specimens were demoulded after 24 hours of casting and were transferred to curing tank where in they were allowed to cure for 28 days. These flexural strength specimens were tested under two point loading as per I.S. 516-1959, over an effective span of 400 mm on Flexural testing machine. Load and corresponding deflections were noted up to failure. In each category three prisms were tested and their average value is reported. The flexural strength was calculated as follows. Flexural strength (MPa) = (P x L) / (b x d2), Where, P = Failure load, L = Centre to

centre distance between the support = 400 mm, b = width of specimen=100 mm, d = depth of specimen= 100 mm

Fig 2.Flexural Test

C. Split Tensile Strength:

For Split tensile strength test, cylinder specimens of dimension 150 mm diameter and 300 mm length were cast. The specimens were demoulded after 24 hours of casting and were transferred to curing tank where in they were allowed to cure for 28 days. These specimens were tested under compression testing machine. In each category three cylinders were tested and their average value is reported. Split Tensile strength was calculated as follows as split tensile strength: Split Tensile strength (MPa) = 2P / π DL, Where, P = failure load, D = diameter of cylinder, L = length of cylinder.

Fig 3.Split Tensile Test

V. RESULT AND DISCUSSION

5.1 Compressive Strength:

The compressive strength of concrete with different proportions of concrete are determined for 7 days, 28 days. The strengths appear to increase gradually and then decrease gradually after a certain proportion of flyash added.

Table 2. Compression Strength Test

S.No	Fly ash %	Specimen	Compressive strength(N/mm^2)	
			7days	28days
1.	SCC	Nominal	21.64	32.80
2.	20%	SP1	21.93	33.12
3.	25%	SP2	18.54	29.87
4.	30%	SP3	17.48	28.96

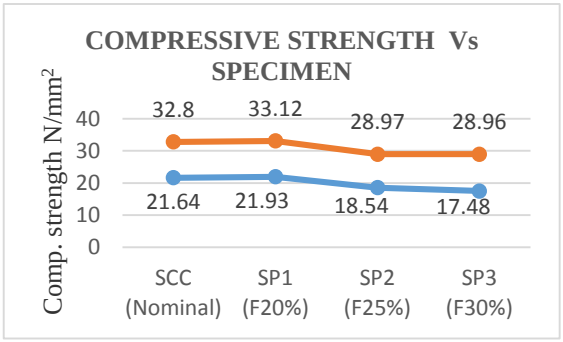


Fig 4. Compressive Strength Variation

5.2 Split Tensile strength

The split tensile strength of the concrete varies with the proportion of flyash added in concrete. The maximum strength is observed for 2% of steel scrap and 20% flyash added concrete

Table 3. Split Tensile Strength Test

Sl. No	Flyash %	Specimen	Split tensile Strength (N/mm^2)	
			7days	28days
1.	SCC	Nominal	2.54	3.76
2.	20%	SP1	2.46	3.79
3.	25%	SP2	2.32	2.98
4.	30%	SP3	2.19	2.76

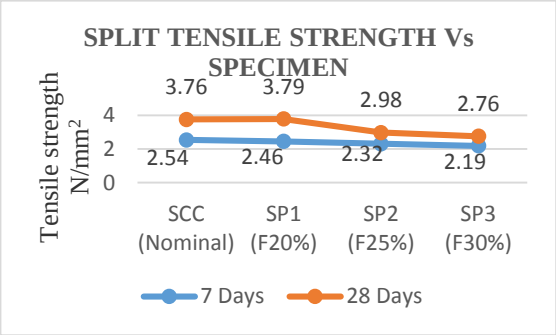


Fig 5. Spilt Tensile Strength Variation

5.3 Flexural Strength

The flexural strength of the prism tested for different proportion shows a gradual increase in flexural strength up to 2% of steel scrap and 20% flyash added concrete and then a gradual decrease in the strength up to 30% flyash.

Table 4. Flexural strength test

Sl. No	Fly ash %	Specimen	Flexural Strength (N/mm^2)	
			7days	28days
1.	SCC	Nominal	3.60	6.78
2.	20%	SP1	3.80	6.82
3.	25%	SP2	3.48	6.43
4.	30%	SP3	3.26	6.04

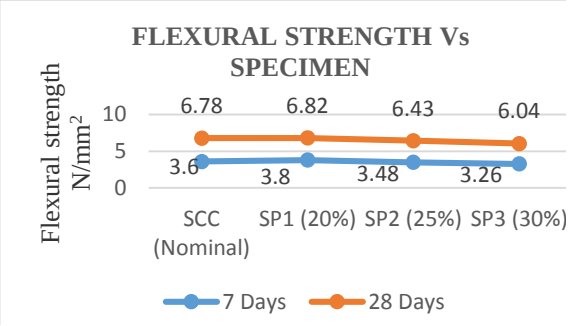


Fig 6. Flexural Strength Variation

VI. CONCLUSION

The SCC mix with the addition of 2% Steel Scraps satisfies the workability limits hardly. The Addition of 20%, 25%, 30% of Fly ash, 2% steel scraps gives good results for flowing and passing ability.As the Same time compressive, split tensile, flexural strength also improved by means of adding steel scraps in 20% and 25%.Hence further addition of fly ash may not satisfy the limits EFNARC Guide lines and mechanical properties may remain constant or decrease.The waste Steel scraps used in self compacting concrete which is now proved to be enhancing the properties of SCC.

VII. FUTURE SCOPE

The effect of rusting of the steel scrap on the strengths of concrete can be determined. Also, the effect of addition of steel scrap on the reinforcement provided in R.C.C structure can be determined.

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Experimental Investigation of Geopolymer concrete 12M By Using Marine sand

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Abstract— This Project presents a detailed experimental Investigation of Geopolymer concrete by Using Marine Sand. The manufacture of ordinary Portland Cement (OPC) releases large amount of Carbon dioxide (CO_2) to the atmosphere that significantly contributes to greenhouse gas emissions. One ton of Carbon dioxide gas is released into the atmosphere for every ton of OPC produced. Therefore there is a need to find alternative type of binders to produce more environmentally friendly concrete. A promising alternative to reduce CO_2 emissions is through the substitution of fly ash for cement. Geopolymers are new promising binder manufactured by activation of a solid alumino silicate source material with a highly alkaline activating solution aided by heat. An Experimental study was conducted to assess the acid resistance of fly ash based Geopolymer concrete specimens. Most of the aggregates used in the manufacture of concrete come from quarries or alluvial rivers. There are bans on the dredging of river sand and are strictly monitored by the government. This Research work examines in the important aggregate for the project work as it was the replacement of regular fine aggregate in 25% , 50%, 75% and 100% of replacement in Geopolymer concrete with 12 M and to evaluation of its Compressive strength , Split Tensile Strength, Flexural Strength Test .

Keywords— Fly ash, Marine sand, NaOH, Na_2Sio_3 ,Conplast SP430.

1. INTRODUCTION

Geopolymer is a type of amorphous alumino-silicate product that exhibits the ideal Properties of rock-forming elements, i.e., hardness, chemical stability and longevity. The properties of geopolymer include high early strength, low shrinkage, freeze-thaw resistance, sulphate resistance and corrosion resistance. These high-alkali binders do not generate any alkali-aggregate reaction. The geopolymer binder is a low-CO_2cementious material. It does not rely on the calcination of limestone that generates CO_2. This technology can save up to 80% of CO_2 emissions caused by the cement and aggregate industries. It is reported that the worldwide cement industry contributes around 1.65 billion tons of the greenhouse gas emissions annually, Due to the production of Portland cement, it is estimated that by the year 2020, the CO_2 emissions will rise by about 50% from the current levels. Therefore, to preserve the global environment from the impact of cement
production, it isnow believed that new binders are indispensable to replace Portland cement. In this regard, the geopolymer concrete is one of the revolutionary developments related to novel materials resulting in low-cost and environmentally friendly material as an alternative to the Portland cement. Geopolymer Concrete is an innovative binder material and is produced by totally replacing the Portland cement. It is demonstrated that the geopolymeric cement generates 5–6 times less CO_2 than Portland cement. Therefore, the use of geopolymer technology not only significantly reduces the CO_2 emissions by the cement

industries, but also utilises the industrial wastes and by-products of alumino-silicate composition to produce added-value construction materials.

II MATERIALS USED

1.Flyash

According to the American Concrete Institute (ACI) Committee, Fly ash is defined as "The finely divided residue that result from the combustion of ground or powdered coal and that is transported by flue gasses from the combustion zone to the particle removal system". Ash that falls in the bottom of the boiler is called bottom ash. Two classes of fly ash are Class F fly ash and Class C fly ash. The chief difference between these classes is the amount of calcium, silca, alumina, and iron content in the ash.

2.Marine Sand

This is the important aggregate for the project work as it was the replacement of regular fine aggregate in the concrete. Marine sand is available in plenty across the globe in the shores of seas. Main chemical to be checked for is chloride content, as it will be responsible for the corrosion of steel which will be used in concrete. It should be in the permissible limits to be used in the concrete and also alternative methods to be adopted for reducing the chloride content. One of the method is to reduce the chloride content to wash the marine sand in water after it will be used. It should be reduces the chloride content.

3. Sodium hydroxide

Sometimes referred to as lye, sodium hydroxide is a chemical compound with a high alkaline content. The properties of the chemical make it ideal for use in a number of different applications, including the manufacture of cleaning products, water purification, and the manufacture of paper products. Because of the alkaline content, sodium hydroxide is a strong skin irritant, making it necessary to handle the product with great care during commercial use. In its pure form, sodium hydroxide takes on the form of flakes or pellets that are a bright white. In this form, the chemical easily absorbs carbon dioxide from any air in the space; this makes it necessary to house the product in a container that is airtight. The fact that that sodium hydroxide is water-soluble helps to make it ideal for use in a number of liquid-based products.

4. Sodium silicate

Sodium silicate, usually known as "water glass" or "liquid glass", is well-known due to wide commercial and industrial application. It is mostly composed of oxygen-silicon polymer backbone lodging water in molecular matrix pores. Sodium silicateproducts are manufactured as solids or thick liquids, depending on proposed use. For instance, water glass functions as a sealant in metal components. Finally, even though, Sodium silicate manufacture is a mature industry, there is current research for a new application given its heat conductive properties.Sodium silicate is a versatile, inorganic chemical made by combining various ratios of sand and soda ash (sodium carbonate) at high temperature. This process yields a variety of products with unique chemistry that are used in many industrial and consumer applications.

5.Alkaline solutions

The common materials used as alkaline solution in producing fly ash-based geopolymer are sodium silicate and sodium hydroxide. Usually either of this material was mixed with sodium hydroxide to produce the alkaline solution and the molarity (M) of alkaline solution is 12 M. The alkaline solution was prepared a day before it is mixed with fly ash.

III PRELIMINARY TEST ON MATERIALS

1.Specific gravity of fly ash

The equipment was dried thoroughly and weighed as W_1 g. The 50 gm of the fly ash was taken and weighed W_2 g. 50gm of the fly ash and Oil is filled in the mark and weighed W_3 g. The instrument was completely filled with a clean cloth . Then the equipment was completely filled with Oil and it was weighed as W_4 g.

Result= Specific Gravity of fly ash = 1.88

2. Specific gravity test of coarse aggregate

The pycnometer dried thoroughly and weighed as W_1 g. one third of the coarse Aggregate were taken and were weighed again with pycnometer as W_2 g. Then sufficient water was added to cover the coarse aggregate half full and was screwed on the top. It was tremble well and stirred thoroughly with the glass rod to entrapped air. After the air has been removed, pycnometer was completely filled with water up to mark. They weighted at W_3 g. The pycnometer was cleaned thoroughly. The container was completely filled with water up to the top. The outside of the container was dried with a clean cloth and was weighed W_4 g.

Result: Specific Gravity of coarse aggregate=2.60

3.Specific gravity test of fine aggregate

The pycnometer was dried thoroughly and weighed as W_1 g. one third of the sand was taken in the pycnometer and weighed as W_2 g. The pycnometer was filled with water upto the top. Then it was shacked well and stirred thoroughly with the glass rod to remove the entrapped air. After the air has been removed, the pycnometer was completely filled with a clean cloth and it was

weighed as W_3 g. The pycnometer was cleanly thoroughly. The pycnometer was completely filled with water up to the top. Then of the pycnometer was dried with a clean cloth and it was weighed as W_4 g.

Result= Specific Gravity Fine Aggregate= 2.64

IV. Mix design

This experimental study is intended to identify the mix ratios for different grades of Geopolymer Concrete by trial and error method. A new Design procedure was formulated for Geopolymer Concrete which was relevant to Indian standard (IS 10262-2009). The applicability of existing Mix Design was examined with the Geopolymer Concrete. Two kinds of systems were considered in this study using 100% replacement of cement by ASTM class F flyash and 100% replacement of sand by M-sand. It was analyzed from the test result that the Indian standard mix design itself can be used for the Geopolymer Concrete with some modification Proportion:

Molority = 12M
Fly ash = 1 (500/500)
F.A = 0.9 (446.22/500)
C.A = 1.8 (891.66/500)
ratio =1 : 0.9 : 1.8
W/C = 0.45

Strength test

- ✓ Compressive strength
- ✓ Split tensile strength
- ✓ Flexural strength

1.Compressive strength test

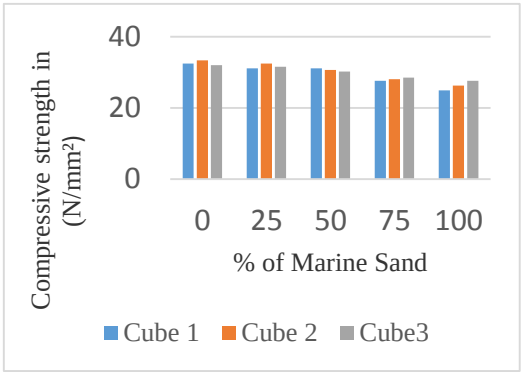
Compressive strength is one of the important properties of concrete.The specimen is then placed in the machine in such a manner that the load shall be applied.The maximum load at failure was taken and compressive strength is calculated using the equation.

$$\text{Compressive strength} = P/A \ (N/mm^2)$$

Where,
P = Ultimate load (KN)
A = Area of specimen (mm^2)

Compressive Strength Test Results

% of Marine sand	Name of the specimen	Load in (KN)	Compressive strength (N/mm^2)	Mean Strength (N/mm^2)
0	1	730	32.44	32.59
	2	750	33.33	
	3	720	32	
25	1	700	31.1	30.96
	2	720	32.44	
	3	730	31.55	
50	1	700	31.1	30.66
	2	690	30.67	
	3	680	30.22	
75	1	620	27.55	27.69
	2	630	28.00	
	3	640	28.44	
100	1	560	24.88	26.21
	2	590	26.22	
	3	620	27.55	



2. Split Tensile Test

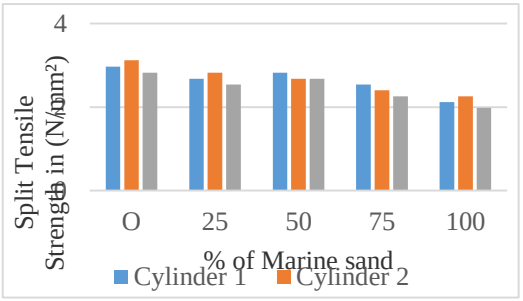
Splitting tensile strength is generally greater than direct tensile strength used to find the tensile strength of cylinder by subjecting the cylinder to a compressive force.The specimen is then placed in the machine in such a manner that the load shall be applied by placing the specimen horizontal.The maximum load at failure was taken and split tensile strength is calculated using the equation.

$$\text{Split tensile strength} = 2P/\pi dl$$

Where,

P = Maximum load at failure (N)
d = Diameter of cylindrical specimen (mm)
l = Length of cylindrical specimen (mm)

% of Marine sand	Name of the specimen	Load in (KN)	Split Tensile Strength (N/mm^2)	Mean Strength (N/mm^2)
0	1	210	2.97	2.97
	2	220	3.12	
	3	200	2.82	
25	1	190	2.68	2.68
	2	200	2.82	
	3	180	2.54	
50	1	200	2.82	2.72
	2	190	2.68	
	3	190	2.68	
75	1	180	2.54	2.40
	2	170	2.40	
	3	160	2.26	
100	1	150	2.12	2.12
	2	160	2.26	
	3	140	1.98	



3.Flexural strength test

Flexural strength is one measure of tensile strength of concrete. The specimen is then placed in the machine in such a manner that the load shall be applied. The maximum load at failure was taken and flexural strength is calculated using the equation.

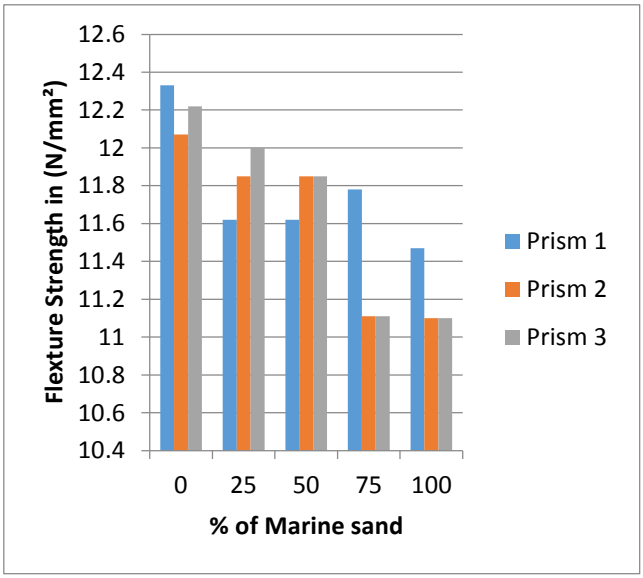
Flexural strength $=3PL/2BD^2$

Where,

P = Maximum Load at failure
L= Length of the specimen
B= Breadth of the specimen
D= Depth of the specimen

Flextural Strength Test Results

% of Marine sand	Name of the specimen	Load in (KN)	Flexture strength (N/mm^2)	Mean Strength (N/mm^2)
0	1	16.4	12.33	12.20
	2	16.1	12.07	
	3	16.3	12.22	
25	1	15	11.62	11.82
	2	15.8	11.85	
	3	16	12.00	
50	1	15.3	11.62	11.77
	2	15.8	11.85	
	3	15.8	11.85	
75	1	15.7	11.78	11.33
	2	14.8	11.11	
	3	14.8	11.11	
100	1	15.3	11.47	11.22
	2	15.1	11.10	
	3	14.8	11.10	



SConclusion

The geopolymerConcrete are environment friendly, since the usage of fly ash which is the waste material and reduction in the green house gases due to the complete cement replacement. Because comparing with the control specimen, the compressive strength of the geopolymer concretespecimen was increased.

- The Geopolymer concrete attain the high strength while comparing normal concrete.
- In this Research Marine sand is successfully replacement of normal sand.
- As compare geopolymer concrete 50% of marine sand replacement is achieve good strength.
- Through out the research Heat curing will achieve high strength.
- Heat curing plays a vital role to reduces the time and increase the strength.
- In this experiment concludes 12 molarity is preferable for usage it achieve the optimum strength.
- The Geopolymerconcrete produce ultimate compressive strength of heat curing in 24 hrs.

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Experimental Investigation of Geopolymer concrete 10M By Using Marine sand

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Abstract— This Project presents a detailed experimental Investigation of Geopolymer concrete by Using Marine Sand. The manufacture of ordinary Portland Cement (OPC) releases large amount of Carbon dioxide (CO_2) to the atmosphere that significantly contributes to greenhouse gas emissions. One ton of Carbon dioxide gas is released into the atmosphere for every ton of OPC produced. Therefore there is a need to find alternative type of binders to produce more environmentally friendly concrete. A promising alternative to reduce CO_2 emissions is through the substitution of fly ash for cement. Geopolymers are new promising binder manufactured by activation of a solid alumino silicate source material with a highly alkaline activating solution aided by heat. An Experimental study was conducted to assess the acid resistance of fly ash based Geopolymer concrete specimens. Most of the aggregates used in the manufacture of concrete come from quarries or alluvial rivers. There are bans on the dredging of river sand and are strictly monitored by the government. This Research work examines in the important aggregate for the project work as it was the replacement of regular fine aggregate in 25% , 50%, 75% and 100% of replacement in Geopolymer concrete with 10 M and to evaluation of its Compressive strength , Split Tensile Strength, Flexural Strength Test .

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1. INTRODUCTION

Geopolymer is a type of amorphous alumino-silicate product that exhibits the ideal Properties of rock-forming elements, i.e., hardness, chemical stability and longevity. The properties of geopolymer include high early strength, low shrinkage, freeze-thaw resistance, sulphate resistance and corrosion resistance. These high-alkali binders do not generate any alkali-aggregate reaction. The geopolymer binder is a low-CO_2cementious material. It does not rely on the calcination of limestone that generates CO_2. This technology can save up to 80% of CO_2 emissions caused by the cement and aggregate industries. It is reported that the worldwide cement industry contributes around 1.65 billion tons of the greenhouse gas emissions annually, Due to the production of Portland cement, it is estimated that by the year 2020, the CO_2 emissions will rise by about 50% from the current levels.Therefore, to preserve the global environment from the impact of cement production, it isnow believed that new binders are indispensable to replace Portland cement. In this regard, the geopolymer concrete is one of the revolutionary developments related to novel materials resulting in low-cost and environmentally friendly material as an alternative to the Portland cement. Geopolymer Concrete is an innovative binder material and is produced by totally replacing the Portland cement. It is demonstrated that the geopolymeric cement generates 5–6 times less CO_2 than Portland cement. Therefore, the use of geopolymer technology not only significantly reduces the CO_2 emissions by the cement industries, but also utilises the industrial wastes and by-products of alumino-silicate composition to produce added-value construction materials.

II MATERIALS USED

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According to the American Concrete Institute (ACI) Committee, Fly ash is defined as "The finely divided residue that result from the combustion of ground or powdered coal and that is transported by flue gasses from the combustion zone to the particle removal system". Ash that falls in the bottom of the boiler is called bottom ash. Two classes of fly ash are Class F fly ash and Class C fly ash. The chief difference between these classes is the amount of calcium, silca, alumina, and iron content in the ash.

2.Marine Sand

This is the important aggregate for the project work as it was the replacement of regular fine aggregate in the concrete. Marine sand is available in plenty across the globe in the shores of seas. Main chemical to be checked for is chloride content, as it will be responsible for the corrosion of steel which will be used in concrete. It should be in the permissible limits to be used in the concrete and also alternative methods to be adopted for reducing the chloride content. One of the method is to reduce the chloride content to wash the marine sand in water after it will be used. It should be reduces the chloride content.

3. Sodium hydroxide

Sometimes referred to as lye, sodium hydroxide is a chemical compound with a high alkaline content. The properties of the chemical make it ideal for use in a number of different applications, including the manufacture of cleaning products, water purification, and the manufacture of paper products. Because of the alkaline content, sodium hydroxide is a strong skin irritant, making it necessary to handle the product with great care during commercial use. In its pure form, sodium hydroxide takes on the form of flakes or pellets that are a bright white. In this form, the chemical easily absorbs carbon dioxide from any air in the space; this makes it necessary to house the product in a container that is airtight. The fact that that sodium hydroxide is water-soluble helps to make it ideal for use in a number of liquid-based products.

4. Sodium silicate

Sodium silicate, usually known as "water glass" or "liquid glass", is well-known due to wide commercial and industrial application. It is mostly composed of oxygen-silicon polymer backbone lodging water in molecular matrix pores. Sodium silicateproducts are manufactured as solids or thick liquids, depending on proposed use. For instance, water glass functions as a sealant in metal components. Finally, even though, Sodium silicate manufacture is a mature industry, there is current research for a new application given its heat conductive properties.Sodium silicate is a versatile, inorganic chemical made by combining various ratios of sand and soda ash (sodium carbonate) at high temperature. This process yields a variety of products with unique chemistry that are used in many industrial and consumer applications.

5.Alkaline solutions

The common materials used as alkaline solution in producing fly ash-based geopolymer are sodium silicate and sodium hydroxide. Usually either of this material was mixed with sodium hydroxide to produce the alkaline solution and the molarity (M) of alkaline solution is 10 M. The alkaline solution was prepared a day before it is mixed with fly ash.

III PRELIMINARY TEST ON MATERIALS

1.Specific gravity of fly ash

The equipment was dried thoroughly and weighed as W_1 g. The 50 gm of the fly ash was taken and weighed W_2 g. 50gm of the fly ash and Oil is filled in the mark and weighed W_3 g. The instrument was completely filled with a clean cloth . Then the equipment was completely filled with Oil and it was weighed as W_4 g.

Result= Specific Gravity of fly ash = 1.88

2. Specific gravity test of coarse aggregate

The pycnometer dried thoroughly and weighed as W_1 g. one third of the coarse Aggregate were taken and were weighed again with pycnometer as W_2 g. Then sufficient water was added to cover the coarse aggregate half full and was screwed on the top. It was tremble well and stirred thoroughly with the glass rod to entrapped air. After the air has been removed, pycnometer was completely filled with water up to mark. They weighted at W_3 g. The pycnometer was cleaned thoroughly. The container was completely filled with water up to the top. The outside of the container was dried with a clean cloth and was weighed W_4 g.

Result: Specific Gravity of coarse aggregate=2.60

3.Specific gravity test of fine aggregate

The pycnometer was dried thoroughly and weighed as W_1 g. one third of the sand was taken in the pycnometer and weighed as W_2 g. The pycnometer was filled with water upto the top. Then it was shacked well and stirred thoroughly with the glass rod to remove the entrapped air. After the air has been removed, the pycnometer was completely filled with a clean cloth and it was weighed as W_3 g. The pycnometer was cleanly thoroughly. The pycnometer was completely filled with water up to the top. Then of the pycnometer was dried with a clean cloth and it was weighed as W_4 g.

Result= Specific Gravity Fine Aggregate= 2.64

IV. MIX DESIGN

This experimental study is intended to identify the mix ratios for different grades of Geopolymer Concrete by trial and error method. A new Design procedure was formulated for Geopolymer Concrete which was relevant to Indian standard (IS 10262-2009). The applicability of existing Mix Design was examined with the Geopolymer Concrete. Two kinds of systems were considered in this study using 100% replacement of cement by ASTM class F flyash and 100% replacement of sand by M-sand. It was analyzed from the test result that the Indian standard mix design itself can be used for the Geopolymer Concrete with some modification. Proportion:

Molority = 10M
Fly ash = 1 (500/500)
F.A = 0.9 (446.22/500)
C.A = 1.8 (891.66/500)
ratio =1 : 0.9 : 1.8
W/C = 0.45

Strength test

- ✓ Compressive strength
- ✓ Split tensile strength
- ✓ Flexural strength

1.Compressive strength test

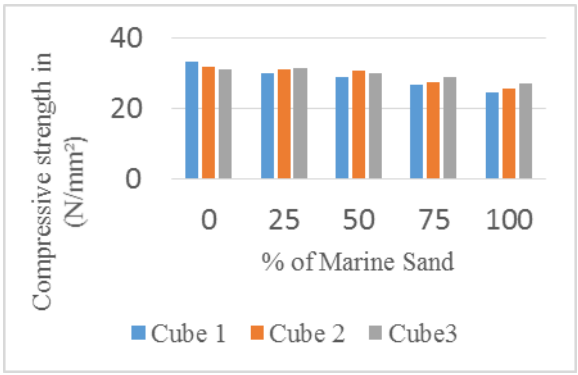
Compressive strength is one of the important properties of concrete.The specimen is then placed in the machine in such a manner that the load shall be applied.The maximum load at failure was taken and compressive strength is calculated using the equation.

Compressive strength = P/A (N/mm^2)

Where,
P = Ultimate load (KN)
A = Area of specimen (mm^2)

Compressive Strength Test Results

% of Marine sand	Name of the specimen	Load in (KN)	Compressive strength (N/mm^2)	Mean Strength (N/mm^2)
0	1	730	32.44	31.84
	2	720	32	
	3	700	31.1	
25	1	650	28.8	29.89
	2	690	30.67	
	3	680	30.22	
50	1	680	30.22	30.96
	2	700	31.11	
	3	710	31.55	
75	1	600	26.7	27.69
	2	620	27.5	
	3	640	28.4	
100	1	550	24.4	25.76
	2	580	25.78	
	3	610	27.11	



2. Split Tensile Test

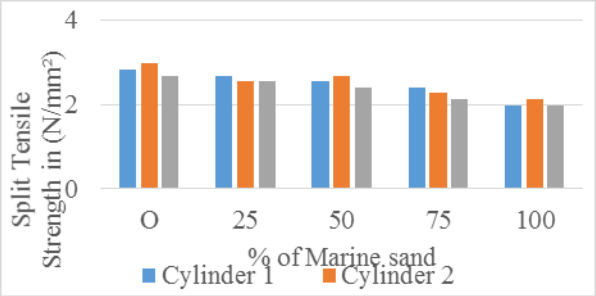
Splitting tensile strength is generally greater than direct tensile strength used to find the tensile strength of cylinder by subjecting the cylinder to a compressive force.The specimen is then placed in the machine in such a manner that the load shall be applied by placing the specimen horizontal.The maximum load at failure was taken and split tensile strength is calculated using the equation.

Split tensile strength = 2P/πdl

Where,

P = Maximum load at failure (N)
d = Diameter of cylindrical specimen (mm)
l = Length of cylindrical specimen (mm)

% of Marine sand	Name of the specimen	Load in (KN)	Split Tensile Strength (N/mm^2)	Mean Strength (N/mm^2)
0	1	200	2.82	2.82
	2	210	2.97	
	3	190	2.68	
25	1	180	2.54	2.54
	2	190	2.68	
	3	170	2.4	
50	1	190	2.68	2.58
	2	180	2.54	
	3	180	2.54	
75	1	170	2.4	2.26
	2	160	2.26	
	3	150	2.12	
100	1	140	1.98	2.02
	2	150	2.12	
	3	140	1.98	



3.Flexural strength test

Flexural strength is one measure of tensile strength of concrete. The specimen is then placed in the machine in such a manner that the load shall be applied. The maximum load at failure was taken and flexural strength is calculated using the equation.

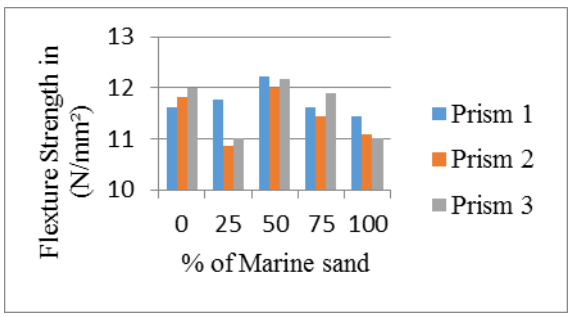
Flexural strength $=3PL/2BD^2$

Where,

P = Maximum Load at failure
L= Length of the specimen
B= Breadth of the specimen
D= Depth of the specimen

Flextural Strength Test Results

% of Marine sand	Name of the specimen	Load in (KN)	Flexture strength (N/mm^2)	Mean Strength (N/mm^2)
0	1	15	11.62	11.82
	2	15.8	11.85	
	3	16	12.00	
25	1	15.7	11.78	11.2
	2	14.4	10.80	
	3	14.7	11.02	
50	1	16.3	12.22	12.12
	2	16	12.00	
	3	16.2	12.15	
75	1	15	11.62	11.64
	2	15.3	11.47	
	3	15.8	11.85	
100	1	15.3	11.47	11.21
	2	14.8	11.10	
	3	14.7	11.06	



Conclusion

The geopolymerConcrete are environment friendly, since the usage of fly ash which is the waste material and reduction in the green house gases due to the complete cement replacement. Because comparing with the control specimen, the compressive strength of the geopolymer concretespecimen was increased.

- The Geopolymer concrete attain the high strength while comparing normal concrete.
- In this Research Marine sand is successfully replacement of normal sand.
- As compare geopolymer concrete 50% of marine sand replacement is achieve good strength.
- Through out the research Heat curing will achieve high strength.
- Heat curing plays a vital role to reduces the time and increase the strength.
- In this experiment concludes 10 molarity is preferable for usage it achieve the optimum strength.
- The Geopolymerconcrete produce ultimate compressive strength of heat curing in 24 hrs.

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Experimental Study On Treatment Of Sullage Waste Water Using Coagulants

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Abstract *— All waters, especially domestic waste waters, contain both dissolved and suspended particles. Coagulation process is used to separate the suspended solids portion from the water. The present study aims to treat the sullage water by various coagulants zia mays, hibiscus rosa sinensis as natural coagulants and ferric chloride, calcium carbonate and as chemical coagulants. The waste water treated by natural coagulants is economical and safe compared to chemical coagulants. For better removal efficiency, the waste water have to treated by using blending of natural and chemical coagulants which have the better removal efficiency. The ratio of natural and chemical coagulant is 2:1. They have high removal efficiency of turbidity, hardness, BOD, Total, suspended and dissolved solids. The treated water can be used for the car washing, gardening and irrigation purposes. Based on the experimental results, it was concluded that natural coagulant and blended coagulant efficiency which can be removed upto 80.88%, 83.82% of turbidity respectively compared to chemical coagulants.*

Keywords- Waste water , Zia mays, hibiscus, coagulation.

I. INTRODUCTION

The earth surface are covered by two third of water but only one percent is pure. The water scarcity and need for water becomes increased nowadays and the disposal of waste water is a global problem in almost all state across the country due to increasing trends. The only solution for that problem is reuse of waste water and the treated water is used for various purpose to avoid the water scarcity.

Waste water is generally made of black water and grey water. Waste water that has been adversely affected in quality by anthropogenic influence. Grey water is also known as sullage water is non industrial wastewater generated from domestic processes such as washing dishes, laundry and bathing. Grey water 65 of waste water .grey water is distinct from black water in the amount and composition of its chemical and biological contaminants. Grey water by definition does not include the discharge of toilets or highly focally contaminated waste water which is designated sewage or black water to indicate it contains human waste. The small traces of feces that enter the grey water stream via effluent from the shower, sink, or washing machine do not pose practical hazards under normal conditions, as long as the grey water is used correctly. Grey water usually contains some traces of excreta and is therefore not free of pathogens. The excreta comes from washing a person's anal area in the bath and shower, or from the laundry.

Demand on conventional water supplies and pressure on sewage treatment systems is reduced by the use of sullage water. Re-using sullage water also reduces the volume of sewage effluent entering watercourses which can be ecologically beneficial. In times of drought, especially in urban areas, greywater use in gardens or toilet systems helps to achieve some of the goals of ecologically sustainable development.

Greater quality of surface and ground water are preserved by natural purification .the benefits of sullage water recycling leads to reduction of water scarcity and helps in ground recharge ,reclamation of nutrients. Sullage water use yields the satisfaction of taking responsibility for the wise husbandry of an important resource. The sullage recycle systems are ideal for residential colonies as well as hotels, hospitals and large institutions. Such systems would help reduce infrastructural costs on public water supply systems as well as avoid heavy losses of water through leakages during distribution through public supply pipelines

. Population growth usually increases demand for water in all sectors of economy: agricultural, industrial and domestic. Due to rapid population growth, unplanned urbanization, surface water pollution and continuous ground water extraction. To

deal with this complicated situation, some innovative measures should be taken to minimize the use of potable water. Recycle and reuse Grey water, rainwater harvesting during monsoon are good options for saving fresh drinking water.

There are several methods to treat the sullage water like ultra filteration, reverse osmosis., etc but the ecofriendly and economic method is coagulation process.It has reduced environmental impact and it is cost effective when compared to rain water harvesting method.

II. MATERIALS AND PREPARATIONS

2.1. Materials

The coagulants which are used in this study are Zia mays , hibiscus rosa sinensis as natural coagulants . Ferric chloride and calcium carbonate as chemical coagulants. The descriptions are given below:

2.1.1. Zia Mays

Zia mays, corn or maize, is a annual grass in the Poaceae (grass family). The maize plant is often 3 m (10 ft) in height, though some natural strains can grow 12 m (39 ft). The stem is commonly composed of 20 internodes of 18 cm (7.1 in) length .In moderate amounts, they also supply dietary fiber and the essential minerals, magnesium and phosphorus whereas other nutrients are in low amounts .they are used in waste water treatment and has the water soluble protein.

2.1.2. Hibiscus rosa sinensies

Hibiscus rosa sinensis belongs to malvaceae family and native to East Asia. It is commonly known as hibiscus, Hawaiian hibiscus, and shoeblack plant. small tree growing 2.5–5 m (8–16 ft) tall and 1.5–3 m (5–10 ft) wide, with glossy leaves . It can also be used as a pH indicator. When used, the flower turns acidic solutions to a dark pink or magenta color and basic solutions to green..It is considered to have a number of medical uses.

2.1.3. Ferric chloride

Ferric chloride is the coagulant of choice for many industrial and sanitary wastewater treatment applications, due to its high efficiency, effectiveness in clarification, and utility as a sludge dewatering agent. The chemical leaves slight residual color, and offers very good turbidity removal. The determination of the optimum pH range and coagulant concentration ultimately depends on the raw water characteristics, and differs for each water source.

2.1.4. Calcium carbonate

Calcium carbonate is a chemical compound with the formula $CaCO_3$. It is a common substance found in rocks as the minerals calcite and aragonite Calcium carbonate is the active ingredient in agricultural lime and is created when calcium ions in hard water react with carbonate ions to create limescale. It is medicinally used as a calcium supplement or as an antacid, but excessive consumption can be hazard. Calcium carbonate is added to swimming pools, as a pH corrector for maintaining alkalinity and offsetting the acidic properties of the disinfectant agent.

2.2. PREPARATION OF MATERIALS

The seed pods of Zia Mays and . Hibiscus rosa sinensies are collected, and dried naturally by sunlight. And remove the seeds from the pod manually. The dried seeds were ground to fine powder by domestic blender. This powder was sieved through 250μm sieve.

III. PHYSIO-CHEMICAL CHARACTERISTICS OF THE SULLAGE WATER

The sample collected was characterised initially on parameters such as pH, BOD, chloride, COD, TSS, TS, TDS, ammoniacal nitrogen, fluoride, DO and hardness,

TABLE 1 INITIAL CHARACTERISTICS

Parameters	***Sullage water characteristics***
pH	6.21
BOD	42
CHLORIDE	344.34
COD	520
TSS	7000
TS	4400
TDS	2600
HARDNESS	853
AMMONIACAL NITROGEN	2.3
FLUORIDE	3.74
DO	4.65

Table 1 shows the characteristics of sullage waste water.

IV. RESULTS AND DISCUSSION

A. COAGULATION PROCESS USING NATURAL COAGULANTS

The coagulation process was done using Zia Mays and Hibiscus rosa sinensis as natural coagulant. In order to determine the optimum dosage of coagulant, different concentration of Zia mays and Hibiscus rosa sinensis powder is being added. Such as 20, 40, 60, 80, 100, 120 mg/L in which the optimum dosage for Zia mays is determined as 60mg/L and 40mglL respectively.

TABLE 2 JAR TEST EXPERIMENT USING NATURAL COAGULANTS

dosage (mg/L)	*turbidity(Zia Mays)NTU*	*turbidity(Hibiscus) NTU*
20	28	36
40	24	21
60	14	25
80	17	29
100	22	37
120	32	41

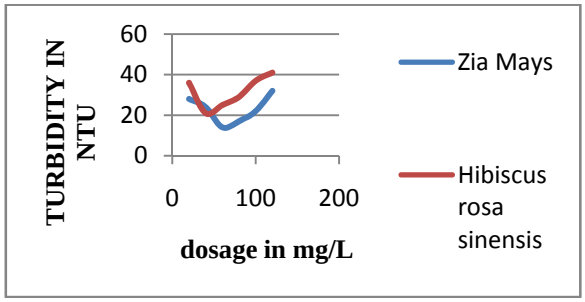

FIG 1 OPTIMUM DOSAGE CURVE FOR NATURAL COAGULANTS

B CHARACTERISTICS OF TREATERD WATER

The characteristics of treated water by using Zia Mays and Hibiscus rosa sinensis.

TABLE 3 *CHARACTERISTICS OF TREATERD WATER*

Parameters	Zia Mays	Hibiscus
pH	7.56	7.83
Turbidity	13 NTU	21 NTU
Hardness	475 mg/L	490 mg/L
Chloride	144.75 mg/L	165.43 mg/L
Ammoniacal nitrogen	0.11 mg/L	0.318 mg/L
Fluoride	0.162 mg/L	0.661 mg/L
Dissolved oxygen	12.68 mg/L	11.04 mg/L
TS	1900 mg/L	1735 mg/L
TDS	1316 mg/L	1017 mg/L
TSS	584 mg/L	718 mg/L
BOD	16.83 mg/L	16.20 mg/L
COD	108 mg/L	120 mg/L

Table shows the removal efficiency of Zia mays and Hibiscus with the maximum of 80.88% and 69.11% respectively.

C COAGULATION PROCESS USING CHEMICAL COAGULANTS

The coagulation process was done using Ferric chloride and calcium carbonate as chemical coagulant. In order to determine the optimum dosage of coagulant, different concentration of Ferric chloride and calcium carbonate is being added. Such as 20, 40, 60, 80, 100, 120 mg/L in which the optimum dosage for Zia mays is determined as 60mg/L and 80mglL respectively.

TABLE 4 JAR TEST EXPERIMENT USING CHEMICAL COAGULANTS

Dosage (mg/L)	*Turbidity($Fecl_3$) NTU*	*Turbidity($Caco_3$) NTU*
20	31	43
40	26	37
60	14	28
80	19	23
100	24	29
120	33	34

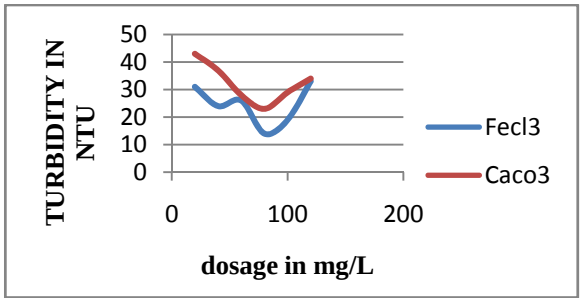

FIG 2 OPTIMUM DOSAGE CURVE FOR CHEMICALL COAGULANTS.

D CHARACTERISTICS OF TREATERD WATER

The characteristics of treated water by using Ferric chloride and Calcium carbonate

TABLE 5 *CHARACTERISTICS OF TREATERD WATER*

Parameters	$Fecl_3$	$Caco_3$
pH	7.46	7.72
Turbidity	14 NTU	23 NTU
Hardness	470 mg/L	503mg/L
Chloride	138.25mg/L	156.334 mg/L
Ammoniacal nitrogen	0.008 mg/L	0.326 mg/L
Fluoride	0.364 mg/L	0.972 mg/L
Dissolved oxygen	12.48 mg/L	10.52 mg/L
TS	1680 mg/L	1863 mg/L
TDS	1047 mg/L	1142 mg/L

TSS	633 mg/L	721 mg/L
BOD	13.6 mg/L	17.1mg/L
COD	208 mg/L	240mg/L

Table shows the removal efficiency of Zia mays and Hibiscus with the maximum of 79.41% and 66.17% respectively..

E *REMOVAL EFFICIENCY*

The removal efficiency of natural and chemical coagulants are determined by the value of reduction of turbidity.

TABLE 6 REMOVAL EFFICIENCY OF COAGULANTS

S.NO	*COAGULANTS*	*REMOVAL EFFICIENCY (%)*
1	Zia mays	80.88
2	Hibiscus	69.11
3	Fec_{l3}	79.41
4	$Caco_3$	66.17

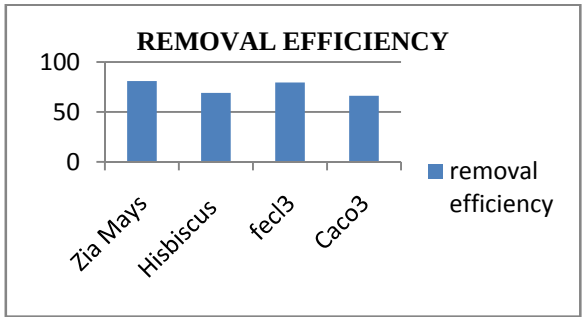

FIG 3 REMOVAL EFFICIENCY OF COAGULANTS

The removal efficiency of Zia Mays and Ferric chloride are almost same. These results are compared with blending of natural and chemical coagulants .

F. *COAGULATION PROCESS USING BLENDED COAGULANTS*

In order to determine the optimum dosage of coagulant, different concentration of Blended coagulation powder is being added in the 2:1 ratio of zia mays and ferric chloride because of effective removal efficiency. The dosage value as 20, 40, 60, 80, 100, 120 mg/L in which the optimum dosage for blended coagulant is determined as 40 mg/L.

TABLE 7 JAR TEST EXPERIMENT USING BLENDED COAGULANTS

Dosage (mg/L)	*Turbidity(ZiaMays +Ferric chloride) NTU*
20	23
40	11
60	19
80	24
100	29
120	35

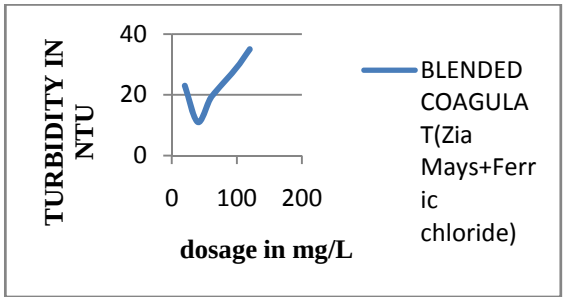

FIG 4 OPTIMUM DOSAGE CURVE FOR BLENDED COAGULANTS

G CHARACTERISTICS OF TREATED WATER

The characteristics of treated water by using Zia Mays and Hibiscus rosa sinensis.

TABLE 8 *CHARACTERISTICS OF TREATERD WATER*

Parameters	Blended coagulants
Ph	7.38
Turbidity	11 NTU
Hardness	436 msg/L
Chloride	131.41 mg/L
Ammoniacal nitrogen	0.072 mg/L
Fluoride	0.983 mg/L
Dissolved oxygen	11.89 mg/L
TS	1592 mg/L
TDS	1112 mg/L
TSS	480 mg/L
BOD	12.86 mg/L
COD	103 mg/L

Table shows the removal efficiency of blending of Zia mays and ferric chloride with the maximum of 83.82%

.

V. CONCLUSION

In this study, it was found that most of natural materials can be used as coagulants. In last few years, great interest has been for using natural coagulants for treatment of waste water. In conclusion, the use of coagulants like zia mays,

hibiscus rosa sinensis, momordica charantia, ferric chloride, calcium carbonate and ferric sulphate has high removal rates for turbidity, hardness, total, dissolved and suspended solids, BOD and COD.

The quality of the waste water treated by using natural coagulant is comparable to the quality of the wastewater treated by chemical coagulant is almost same. But the removal efficiency of natural coagulant is better than chemical coagulant. The highest removal efficiency among the six coagulants is the zia mays about 80.88% and ferric chloride about 79.41%.The use of natural coagulant is economical and safe. Some cases chemical coagulants cause hazards effects among people. The efficiency of blended coagulation of zia mays and ferric sulphate is high about 83.82%. So we suggest both natural coagulants and blending of natural and chemical coagulant for the treatment of sullage water.

More research is needed to achieve a greater efficiency in contaminant removal with respect to certain modifications in its functional group or various treatment procedures of the plant and its part that can be focused upon in near future. The reuse of waste water is necessary in the future because of the water scarcity.

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EVALUATION OF MATERIAL WASTE MANAGEMANT IN SMALL SCALE CONSTRUCTION PROJECTS

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ABSTRACT— The objective of this paper is to study the material waste management in small scale construction sites. The questionnaire is designed based on the attributes for material waste. The survey was conducted in and around Tamilnadu. The responses from project managers and contractor of major, minor and small projects were collected. The received responses were analyzed using SPSS. Based on the study, suggestions for waste reduction in construction sites are made.

KEYWORDS— *Recycle and reuse of materials, Material waste management, Construction waste.*

1. INTRODUCTION

The increasing amounts of construction waste cause rapid depletion of landfill space available and bring about an increasing demand for natural aggregates, thereby inflicting ecological and environmental damages on the earth. Thus, how to reduce the generation of construction waste and how to ease the impact of wastes generated on the ecosystem are recognized as critical social issues on the global scale. This research is focused on modelling waste-handling processes in construction, with particular emphasis on mapping and simulation of on-site waste sorting processes.

Objectives of waste management

The main objective of material waste management is to reduce the material waste in on-site and off-site.

- To reduce the generation of construction wastes.
- To minimize the cost incurred for material wastage.
- To create an economical project by minimizing the materials.
- To formulate a simulation model for material wastes.

2. NEEDS FOR CONSTRUCTION WASTE MANAGEMENT

• Need for salvage, recycle and reuse of materials have proven to have economic benefits for the construction industry.

Fig 1. Need for construction waste management

• To reduce the material wastage
• Proper disposal of waste material
• Ranging from low risk waste through to hazards waste.

3. SOURCES AND CAUSES OF WASTE

Operational waste

Errors by trade persons or laborers, accidents due to negligence, damage to work done caused by subsequent trades, use of incorrect material

- Required quantity uncleared due to improper planning
- Equipment malfunctioning.
- Inclement weather.

Design waste

- Lack of attention paid to dimensional co-ordination,
- Changes made to the design while construction is in progress.

- Designer's inexperience in method and sequence of construction.
- Lack of attendance paid to standard size available in the market.
- Designer's unfamiliarity with alternative products, complexity and errors.
- Incomplete contract documents, selection of low quality products.

Material handling waste

- Damages during transportation & inappropriate storage.
- Materials supplied in loose form.
- Use of material which are closed to working place.
- Unfriendly attitude of project team and laborers, theft.

Procurement waste

- Ordering errors.
- Lack of possibilities to order small quantities.
- Purchased products that do not comply with specification.

4. Methodology

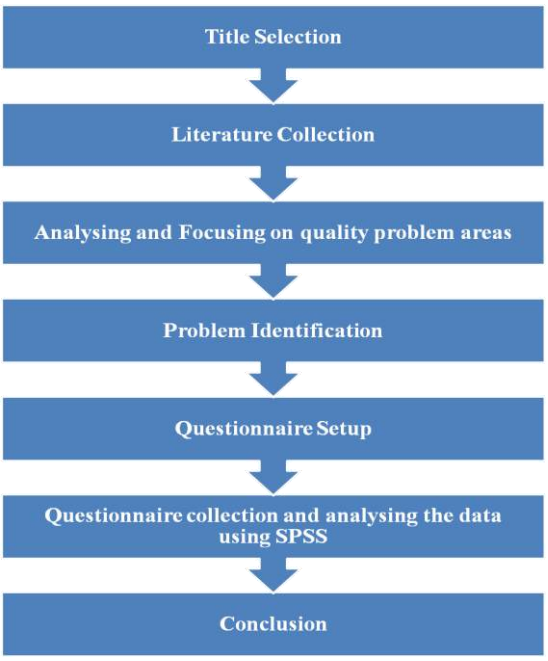


Fig 2. Methodology

design of questionnaire

A questionnaire was designed to understand more about the material management in the construction industry. Data was collected from the responsible persons from the site such as project manager, project engineer or site engineer. Questionnaire mainly focused on the following areas

- Company details.
- Documentation details.
- Details of material usage
- Details of material storage
- Methods for wastage reduction

5. Results and discussion

Collected data were analyzed using statistical tools analysis method, SPSS (Statistical package for the social sciences) is a statistical analysis and data management software package. SPSS can take data from almost any type of file and use them to generate tabulated reports, charts, and plots of distribution and trends, descriptive statistics, and conduct complex statistical analyses.

Some of the analysis results of the questionnaire were shown below.

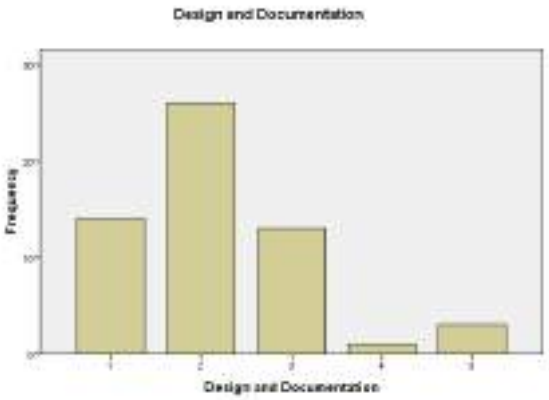
FREQUENCY TABLE

Design and Documentation

Valid	Frequency	Percent	Valid Percent	Cumulative Percent
1	14	24.6	24.6	24.6
2	26	45.6	45.6	70.2
3	13	22.8	22.8	93.0
4	1	1.8	1.8	94.7
5	3	5.3	5.3	100.0
Total	57	100.0	100.0	

INFERENCE

The inference made from response of construction employees and owners 24.6% are Very low Severity rating of material waste management projects are due to "Organization Chart", 45.6 % of the respondent says Low, 22.8 % of the respondent says medium, 1.8 % of the respondent says high, 5.3% of the respondent says very high.

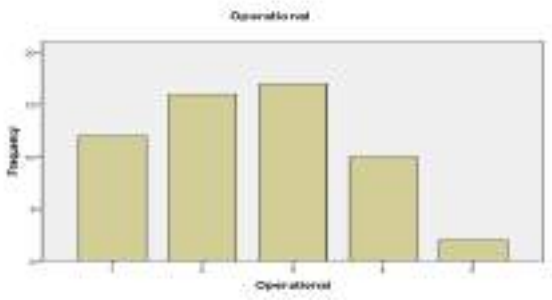


Operational

Valid	Frequency	Percent	Valid Percent	Cumulative Percent
1	12	21.1	21.1	21.1
2	16	28.1	28.1	49.1
3	17	29.8	29.8	78.9
4	10	17.5	17.5	96.5
5	2	3.5	3.5	100.0
Total	57	100.0	100.0	

INFERENCE

The inference made from response of construction employees and owners 21.1% are Very low Severity rating of material waste management projects are due to "Organization Chart", 28.1 % of the respondent says Low, 29.8 % of the respondent says medium, 17.5% of the respondent says High,3.5 % of the respondent says Very High.

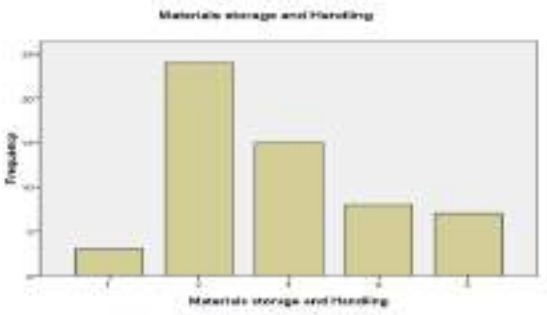


Materials storage and Handling

Valid	Frequency	Percent	Valid Percent	Cumulative Percent
1	3	5.3	5.3	5.3
2	24	42.1	42.1	47.4
3	15	26.3	26.3	73.7
4	8	14.0	14.0	87.7
5	7	12.3	12.3	100.0
Total	57	100.0	100.0	

INFERENCE

The inference made from response of construction employees and owners 5.3% are Very low Severity rating of material waste management projects are due to "Organization Chart", 42.1 % of the respondent says Low, 26.6 % of the respondent says medium, 14.0% of the respondent says High, 12.3 % of the respondent says Very High.

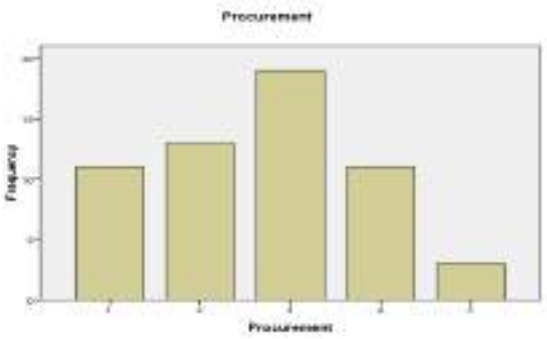


Procurement

Valid	Frequency	Percent	Valid Percent	Cumulative Percent
1	11	19.3	19.3	19.3
2	13	22.8	22.8	42.1
3	19	33.3	33.3	75.4
4	11	19.3	19.3	94.7
5	3	5.3	5.3	100.0
Total	57	100.0	100.0	

INFERENCE

The inference made from response of construction employees and owners 19.3% are Very low Severity rating of material waste management projects are due to "Organization Chart", 22.8 % of the respondent says Low, 33.3 % of the respondent says medium, 19.3 % of the respondent says High, 5.3 % of the respondent says Very High.



Conclusion

This study clearly indicates that, most of the materials in construction sites get wasted because of the erroneous waste management policy and failure in records maintenance. Contractor's poor involvement and lack of knowledge in the material management intensifies the problem further. The maximum amount of sand, brick and steel gets wasted all because of its storage condition. Whatever

the project cost is high, the storage for sand, brick and steel is open at the site and due to impossible storage, these materials gets more wasted. This increase in waste not only increase the total cost of the project but also the span of the project also gets delayed. Hence it is suggested to provide a proper storage for all these materials at the site and the handling should be done in a proper manner. More careful is needed while placing and transporting the materials. It we reduce these types of waste; the project can be completed in an economical and effective manner.

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DURABILITY STUDY ON LIGHT WEIGHT BRICKS USING PERLITE AND LIME MATERIAL

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***Abstract*—** The aim of this study is investigation of brick reproducibility using expanded perlite aggregate as the main raw material. Engineering parameters such as weight per unit of volume, mechanical strength of produced control brick with a dimension of 190 x 90 x 90 mm were determined and optimized. The chemical composition of perlite are 70-75 % silicon oxide (SiO_2), 12-15 % Aluminium Oxide (Al_2O_3), 3-4 % Sodium oxide (Na_2O), 3-5 % Potassium oxide (K_2O), 0.5-2 % Iron oxide(Fe_2O_3), 0.2-0.7 % Magnesium oxide (MgO), 0.5-1.5 % Calcium oxide (CaO), 3-5 % loss on ignition (chemical / combined water). Its thermal, lightness, and acoustic insulation properties make perlite an excellent material to be used as lightweight aggregate in brick manufacturing.Binding materials such as cement, gypsum, lime, bitumen and clay were used for manufacturing perlite brick.These bricks were tested for compressive strength, water absorption, efflorescence, Density and sound test as per Indian Standards. Brick in standard sizes manufactured at different perlite–lime Ratios and unit weight, compressive strength, volume reduction and heat conductivity values were obtained. Then the mixture with the best combination of the properties was determined and cost optiminization was described.

***Keywords*—**Expanded Perlite,Lime Powder,Water;Specific gravity;bulk density,Water absorption.

1.INTRODUCTION

1.1 GENERAL

Perlite is used in various areas such as construction materials, agriculture, medical and chemical industry. Moreover, expanded perlite aggregate (EPA) has been used within the constructional elements such as brick, plaster, pipe, wall and floor block; however has not been industrially utilized in concrete yet. EPA is a heat and sound insulator, and lightweight material which ensures economic benefits in constructions. Such well burnt bricks do not breakdown when immersed in water. The temperatures in these kilns go 700 – 1100 degree celcious. In this chapter we will deal with the manufacturing of clay bricks and methods of testing them for use in building construction. The chemical composition of Perlite are: 70–75% Silicon Oxide: SiO_2,12–15% Aluminum Oxide:Al_2O_3, 3–4% Sodium oxide: Na_2O, 3–5% Potassium Oxide: K_2O, 0.5-2% Iron oxide: Fe_2O_3, 0.2–0.7% Magnesium oxide: MgO, 0.5–1.5% Calcium oxide CaO 3–5% loss on ignition (chemical / combined water). Perlite is used in industries,

agriculture, horticultural aggregate, vermiculite, refractory material, ladle topping, building construction products, fillers, filter aid and used in hot tops and risers. This paper summarizes the study of chemical and physical properties of Perlite and its application in India.

1.2 PERLITE:

Perlite is a type of volcanic rock with pearly lustre. It expands and becomes porous when heated. Colour of crude perlite is light grey to glossy black whereas, thecolour of expanded perlite ranges from snowy white to greyish white. Distinguishing feature apart from other volcanic glasses is that perlite when heated to about 850-900 °C expands 4 to 20 times its original volume. This expansion is due to the presence of 2 to 5% combined water in crude perlite which when heated vaporises to form countless tiny bubbles. Expanded perlite is not only amazingly light weight, but also has exceptional physical properties. Unexpanded (raw) perlite has a bulk density around 1100 kg/m3 (1.1 g/cm3), while typical expanded perlite has a bulk density of about 30-150 kg/m3.Perlite is used in industry in both the forms-Crude Perlite and Expanded Perlite. Most perlite is expanded to produce ultra light perlite by heating. Crude perlite is prepared by crushing and screening to various size fractions.

Figure.1.1

1.2.1 EXPANDED PERLITE:

Expanded perlite aggregate EPA has been used in constructional elements such as brick, plaster, pipe, wall, and floor block, however, has not been industrially used in concrete yet. Perlite is a glassy form of rhyolitic or dacitic magma. It contains 2–5% water. Upon rapid heating, perlite transforms into a cellular material of low bulk density. As the chemical water held within the perlite boils at temperatures of 900–1,100°C, the resultant steam forms bubbles within the softened rock to produce a frothy like structure. The formation of these bubbles allows perlite to expand up to 4–20 times of its original volume.

Thermal conductivity has been defined as “the rate of flow of heat per unit area per unit temperature gradient when heat flow is under steady state conditions” Tennent 1997. The thermal conductivity of porous materials depends on various parameters, such as the thermal properties of the constituent phases and the microstructure parameters, which include the volume fractions of the constituent phases, geometrical distribution of the phases, the size and size distribution of the particles, and the geometry of the individual papers.

Figure.1.2

1.2.1.1 PHYSICAL PROPERTIES OF EXPANDED PERLITE

Property of EPA	Determined limits
Color	White
Specific gravity	0.28
Unit weight kg/m^3	30–190
Porosity %	90
Specific heat kCal/kg °C	0.20–0.23
Melting point °C	1,300
Thermal conductivity W/mK	0.039–0.046
Thermal expansion mm/m °C	0.004–0.011

1.2.1.2 CHEMICAL PROPERTIES OF EXPANDED PERLITE

Component	Content in %
SiO_2	70.68
Al2O3	13.04
Na_2O	3.54
K_2O	4.34
Fe2O3	1.04
CaO + MgO	3.78
Other	3.38

1.2.2 ADVANTAGES OF EXPANDED PERLITE:

Industrial applications for Perlite are the most diverse, ranging from high performance fillers for plastics to cement for petroleum, water and geothermal wells. Other applications include its use as a filter media for pharmaceuticals, food products, chemicals and water for municipal systems and swimming pools. Additional applications include its use as an abrasive in soaps, cleaners, and polishes; and a variety of foundry applications utilizing Perlite insulating properties and high heat resistance. This same heat resistant property is taken advantage of when Perlite is used in the manufacture of refractory bricks, mortars, and pipe insulation. Over half of all the Perlite expanded in the United States annually is used to make ―formed products.‖ These products include ceiling tiles, pipe insulation, roofing board and fire-rated door cores, and are manufactured with a variety of binders. Perlite can safely be used over a wide range of temperatures. Being lightweight, non-combustible, and insulating, Perlite has been found to be useful in a wide variety of industrial applications, e.g., refractory brick, high temperature insulation, molten metal topping, cryogenic insulation, filtration, and lightweight fillers. Perlite and vermiculite are both used to improve moisture retention and aeration in soil. They are used in a similar manner, but they are not interchangeable. Perlite and vermiculite are quite different in composition and in how they improve your soil. Determining which is better for use in your garden depends on your plants and their needs.There are many uses for perlite. These uses can be broken down into three general categories: construction applications, horticultural applications, and industrial applications.

1.3 LIME POWDER:

Locally available Lime powder were used in this work. limestone is a general term for rocks that contain 80% or more of calcium or magnesium carbonates, including marble, chalk, and marl. lime has an adhesive property with bricks and stones, it is often used as binding material in masonry works.

Lime is a calcium-containing inorganic material in which carbonates, oxides, and hydroxides predominate. In the strict sense of the term, lime is calcium oxide or calcium hydroxide. It is also the name of the natural mineral (native lime) CaO which occurs as a product of coal seam fires and in altered limestonexenoliths in volcanic ejecta.[1] The word "lime" originates with its earliest use as building mortar and has the sense of "sticking or adhering".

The rocks and minerals from which these materials are derived, typically limestone or chalk, are composed primarily of calcium carbonate. They may be cut, crushed or pulverized and chemically altered. "Burning" (calcination) converts them into the highly caustic material "quicklime" (calcium oxide, CaO) and, through subsequent addition of water, into the less caustic (but still strongly alkaline) "slaked lime" or "hydrated lime" (calcium hydroxide, $Ca(OH)_2$), the process of which is called "slaking of lime". Lime kilns are the kilns used for lime burning and slaking.

When the term is encountered in an agricultural context, it usually refers to agricultural lime, which is crushed limestone, not a product of a lime kiln. Otherwise it most commonly means slaked lime, as the more dangerous form is usually described more specifically as quicklime or "burnt lime".

Figure.1.3 Lime Powder

1.3.1 PHYSICAL PROPERTIES OF LIME POWDER:

PHYSICAL APPEARANCE	WHITE POWDER
SPECIFIC GRAVITY	2.2
pH(1%solution)	12.4
SOLUBILITY@20°C(68°F)	0.165 g/100ml water
BULK DENSITY	2210.5kg/m^3(138 lb/ft^3)

1.3.2 CHEMICAL PROPERTIES OF LIME POWDER:

CHEMICAL PROPERTIES	
Chemically, both limestone and marbles are siliceous calcium carbonate rocks.	
Lime (CaO)	38-42%
Silica (SiO2)	20-25%
Alumina (Al2O3)	2-4%
Other Oxides like Na, Mg	1.5 to 2.5%
Loss On Ignition (LOI)	30-32%

1.4 AIM

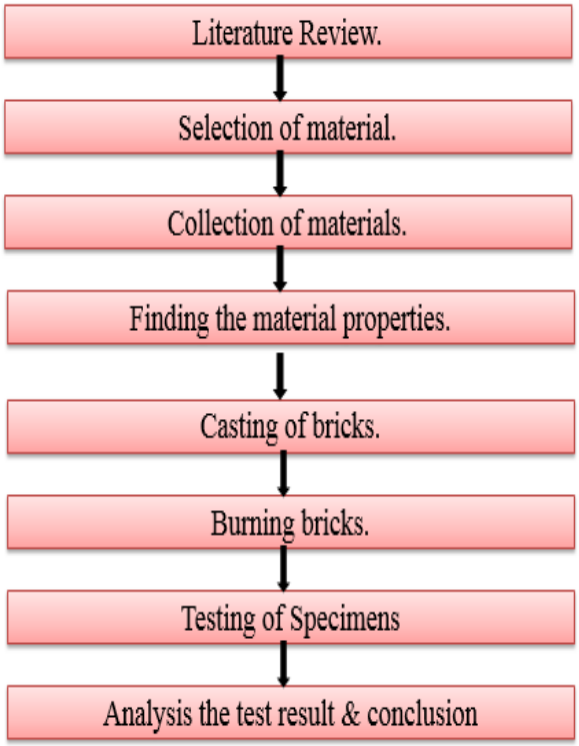
To Experimental study on light weight bricks using perlite and lime materials**.**

1.5 SCOPE :

- ❖To reduce the weight of the bricks.
- ❖Floating bricks.
- ❖To avoid the accidents of fire industries.

2.METHODOLOGY:

2.1 FLOWCHART:



The methodology of the project involves collection of literature and necessary documents required for the experimental work. After the sufficient documents are collected, the materials required for the experimental work is collected, and tested for its originality against the project specifications. When the materials satisfy the project specifications, the specimens (bricks) are to be casted and are to be burned under normal bricks conditions.

When the materials are burned, the bricks are tested for their compression strength, and the water absorption test.

3. MATERIAL COLLECTION AND TESTING

3.1 MATERIAL PROPERTIES:

3.1.1 Specific gravity test of Expanded perlite:

The empty specific gravity bottle designed and was taken as (w1).The bottle was filled with perlite and the weight is taken as (w2).The specific gravity bottle was filled with perlite and water weighed which was taken as (w3).Roll the bottle in the incline position until no further air bubble rise to the surface. Fill the bottle to the top with water and weight (w4).

Specific gravity of EPA = $\left(\frac{W2-W1}{(W2-W1)-(W3-W4)}\right)$

Figure:3.1.specific gravity test

3.1Specific gravity of Expanded Perlite

Description	Weight in g		
	Trial I	Trial II	Trial III
Weight of empty mould (W_1)	611	611	611
Weight of mould +EPA (W_2)	630	620	629
Weight of mould + EPA +water (W_3)	1450	1468	1465
Weight of mould + water (W_4)	1510	1510	1510

4.EXPERIMENTAL PROGRAM:

This Indian Standard was adopted by the Indian Standards Institution on 17 November 1968, after the draft finalized by the Flooring and Plastering Sectional Committee had been approved by the Civil Engineering Division Council. These bricks are made of raw materials, such as clay or shale of suitable composition with low lime and iron content, felspar, flint or sand, and vitrified at high temperatures in ceramic kilns. These bricks are-designed primarily for use in chemical and allied industries and are normally used with chemical resistant mortars.

This standard covers the requirements for bricks intended for use where minimum absorption is required and thermal shock and alkali resistance are not important service factors. In the formulation of this standard due weightage has been given to international co-ordination among the standards and practices prevailing in different countries in addition to relating it to the practices in the field in this country.

It is necessary to Check the quality of brick before using it in any construction activities. There are some field tests that we can conducting the field in order to check the quality of bricks. A Brick is generally subjected to the following tests to find for the Construction work. These tests are as follows.

Bulk Density Test,Water Absorption Test

4.1.BULK DENSITY TEST:

1.The brick is dried in a ventilated oven at a temperature of 105^0 to 115^0C till it attains substantially constant mass.

2.The brick is then cooled to room temperature and its mass is recorded.(M)

3.Then the dimensions of the brick is measured accurately and the volume is calculated.(V)

$$\text{Bulk density} = \frac{Mass(M)}{Volume(V)}$$

Figure.4.1.bulk density test

BRICK RATIO	TRIAL I	TRIAL II	TRIAL III	AVERAGE WEIGHT IN Kg	BULK DENSITY Kg/m³
CONVENTIONAL BRICK	2.8	2.89	3.1	2.93	1465
B1 (70,30)	1.020	1.000	1.094	1.038	674.44
B2 (75,25)	0.990	0.987	0.984	0.987	641.32
B3 (80,20)	0.960	0.955	0.953	0.956	621.18
B4 (85,15)	0.850	0.866	0.853	0.856	556.20

Average bulk density of perlite bricks = 623.28 Kg/m^3

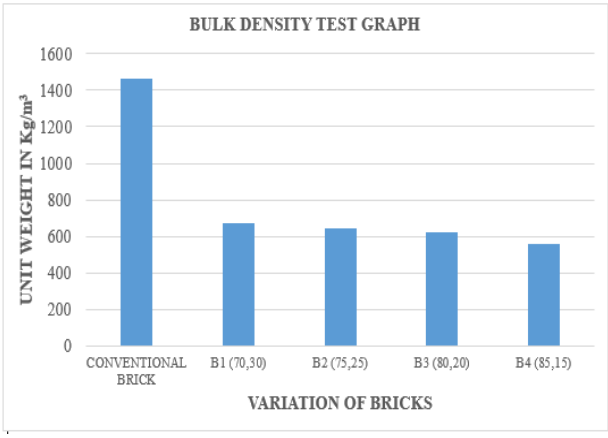


Figure:4.1. graph for bulk density test results

4.2.WATER ABSORPTION TEST:

In this test bricks are weighed in dry condition and let them immersed in fresh water for 24 hours. After 24 hours of immersion those are taken out from water and wipe out with cloth. Then brick is weighed in wet condition. The difference between weights is the water absorbed by brick. The percentage of water absorption is then calculated. The less water absorbed by brick the greater its quality. Good quality brick doesn't absorb more than 20% water of its own weight.

$$\text{Water absorption} = \frac{M_2 - M_1}{M_1} \times 100$$

BRICK RATIO	TRIAL 1	TRIAL 2	AVERAGE WATER ABSORPTION
CONVENTIONAL BRICK	11.56	9.41	10.48
B1(70,30)	23.99	21.81	22.9
B2(75,25)	22.42	21.61	22.0
B3(80,20)	20.19	20.3	20.24
B4(85,15)	31.5	31.99	31.75

Average water absorbtion value in % = 24.7

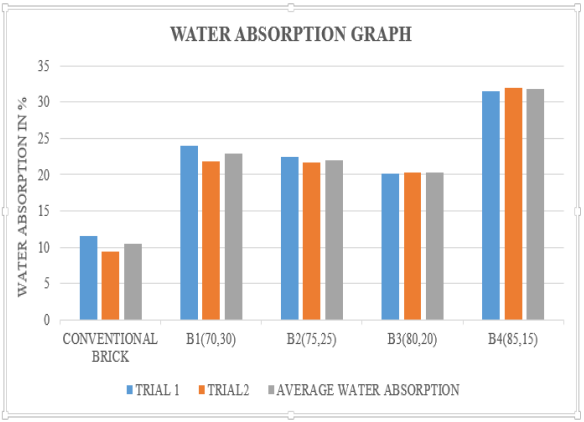


Figure 4.3 Graph of Water Absorption test

5.CONCLUSION:

The low unit weight is one of the most important features for the bricks and construction sector.declared that the low density of bricks is related with internal micropores and it reduces the load in buildings and finally reduces the logistical costs.Water absorption of B3 (80,20) Brick is ,compare to lower than other ratios. The less water absorbed by brick the greater its quality. Good quality brick doesn't absorb more than 20% water of its own weight.This Brick is floating into the water.

Acknowledgement

We wish to express our sincere thanks to Dr. S.Shahul Hameed. ME., Ph.D., Head of the Department of Civil Engineering, for his kind advice and constant encouragement. We Record my deep sense of thanks to Project coordinator and always my beloved Guide Mr. L.Arunraja. M.E., Department of Civil Engineering, for his constant help and creative ideas over the period of project work. We would like to extend our warmest thanks to all our Staff members for helping us in this venture. Unflinching support and encouragement from the members of my family, friends in P.S.R ENGINEERING COLLEGE helped us a long way to complete our project work. We must thank them all from depths of our heart.

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MECHANICAL PROPERTIES OF LIGHT WEIGHT BRICKS USING PERLITE AND LIME MATERIAL

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Abstract— The aim of this study is investigation of brick reproducibility using expanded perlite aggregate as the main raw material. Engineering parameters such as weight per unit of volume, mechanical strength of produced control brick with a dimension of 190 x 90 x 90 mm were determined and optimized. The chemical composition of perlite are 70-75 % silicon oxide (SiO_2), 12-15 % Aluminium Oxide (Al_2O_3), 3-4 % Sodium oxide (Na_2O), 3-5 % Potassium oxide (K_2O), 0.5-2 % Iron oxide(Fe_2O_3), 0.2-0.7 % Magnesium oxide (MgO), 0.5-1.5 % Calcium oxide (CaO), 3-5 % loss on ignition (chemical / combined water). Its thermal, lightness, and acoustic insulation properties make perlite an excellent material to be used as lightweight aggregate in brick manufacturing.Binding materials such as cement, gypsum, lime, bitumen and clay were used for manufacturing perlite brick.These bricks were tested for compressive strength, water absorption, efflorescence, Density and sound test as per Indian Standards. Brick in standard sizes manufactured at different perlite–lime Ratios and unit weight, compressive strength, volume reduction and heat conductivity values were obtained. Then the mixture with the best combination of the properties was determined and cost optiminization was described.

Keywords—Expanded Perlite,Lime Powder,Water;Specific gravity;Compression test.

1.INTRODUCTION

1.1 GENERAL

Perlite is used in various areas such as construction materials, agriculture, medical and chemical industry. Moreover, expanded perlite aggregate (EPA) has been used within the constructional elements such as brick, plaster, pipe, wall and floor block; however has not been industrially utilized in concrete yet. EPA is a heat and sound insulator, and lightweight material which ensures economic benefits in constructions.

Such well burnt bricks do not breakdown when immersed in water. The temperatures in these kilns go 700 – 1100 degree celcious. In this chapter we will deal with the manufacturing of clay bricks and methods of testing them for use in building construction. The chemical composition of Perlite are: 70–75% Silicon Oxide: SiO_2,12–15% Aluminum Oxide:Al_2O_3, 3–4%

Sodium oxide: Na_2O, 3–5% Potassium Oxide: K_2O, 0.5-2% Iron oxide: Fe_2O_3, 0.2–0.7% Magnesium oxide: MgO, 0.5–1.5% Calcium oxide CaO 3–5% loss on ignition (chemical / combined water). Perlite is used in industries, agriculture, horticultural aggregate, vermiculite, refractory material, ladle topping, building construction products, fillers, filter aid and used in hot tops and risers. This paper summarizes the study of chemical and physical properties of Perlite and its application in India.

1.2 PERLITE:

Perlite is a type of volcanic rock with pearly lustre. It expands and becomes porous when heated. Colour of crude perlite is light grey to glossy black whereas, thecolour of expanded perlite ranges from snowy white to greyish white. Distinguishing feature apart from other volcanic glasses is that perlite when heated to about 850-900 °C expands 4 to 20 times its original volume. This expansion is due to the presence of 2 to 5% combined water in crude perlite which when heated vaporises to form countless tiny bubbles. Expanded perlite is not only amazingly light weight, but also has exceptional physical properties. Unexpanded (raw) perlite has a bulk density around 1100 kg/m3 (1.1 g/cm3), while typical expanded perlite has a bulk density of about 30-150 kg/m3.Perlite is used in industry in both the forms- Crude Perlite and Expanded Perlite. Most perlite is expanded to produce ultra light perlite by heating. Crude perlite is prepared by crushing and screening to various size fractions.

Figure.1.1

1.2.1 EXPANDED PERLITE:

Expanded perlite aggregate EPA has been used in constructional elements such as brick, plaster, pipe, wall, and floor block, however, has not been industrially used in concrete yet. Perlite is a glassy form of rhyolitic or dacitic magma. It contains 2–5% water. Upon rapid heating, perlite transforms into a cellular material of low bulk density. As the chemical water held within the perlite boils at temperatures of 900–1,100°C, the resultant steam forms bubbles within the softened rock to produce a frothy like structure. The formation of these bubbles allows perlite to expand up to 4–20 times of its original volume.

Thermal conductivity has been defined as “the rate of flow of heat per unit area per unit temperature gradient when heat flow is under steady state conditions” Tennent 1997. The thermal conductivity of porous materials depends on various parameters, such as the thermal properties of the constituent phases and the microstructure parameters, which include the volume fractions of the constituent phases, geometrical distribution of the phases, the size and size distribution of the particles, and the geometry of the individual papers.

Figure.1.2

1.2.1.1 PHYSICAL PROPERTIES OF EXPANDED PERLITE

Property of EPA	Determined limits
Color	White
Specific gravity	0.28
Unit weight kg/m^3	30–190
Porosity %	90
Specific heat kCal/kg °C	0.20–0.23
Melting point °C	1,300
Thermal conductivity W/mK	0.039–0.046
Thermal expansion mm/m °C	0.004–0.011

1.2.1.2 CHEMICAL PROPERTIES OF EXPANDED PERLITE

Component	Content in %
SiO_2	70.68
Al2O3	13.04
Na_2O	3.54
K_2O	4.34
Fe2O3	1.04
CaO + MgO	3.78
Other	3.38

1.2.2 ADVANTAGES OF EXPANDED PERLITE:

Industrial applications for Perlite are the most diverse, ranging from high performance fillers for plastics to cement for petroleum, water and geothermal wells. Other applications include its use as a filter media for pharmaceuticals, food products, chemicals and water for municipal systems and swimming pools. Additional applications include its use as an abrasive in soaps, cleaners, and polishes; and a variety of foundry applications utilizing Perlite insulating properties and high heat resistance. This same heat resistant property is taken advantage of when Perlite is used in the manufacture of refractory bricks, mortars, and pipe insulation. Over half of all the Perlite expanded in the United States annually is used to make ―formed products.‖ These products include ceiling tiles, pipe insulation, roofing board and fire-rated door cores, and are manufactured with a variety of binders. Perlite can safely be used over a wide range of temperatures. Being lightweight, non-combustible, and insulating, Perlite has been found to be useful in a wide variety of industrial applications, e.g., refractory brick, high temperature insulation, molten metal topping, cryogenic insulation, filtration, and lightweight fillers. Perlite and vermiculite are both used to improve moisture retention and aeration in soil. They are used in a similar manner, but they are not interchangeable. Perlite and vermiculite are quite different in composition and in how they improve your soil. Determining which is better for use in your garden depends on your plants and their needs.There are many uses for perlite. These uses can be broken down into three general categories: construction applications, horticultural applications, and industrial applications.

1.3 LIME POWDER:

Locally available Lime powder were used in this work. limestone is a general term for rocks that contain 80% or more of calcium or magnesium carbonates, including marble, chalk, and marl. lime has an adhesive property with bricks and stones, it is often used as binding material in masonry works.

Lime is a calcium-containing inorganic material in which carbonates, oxides, and hydroxides predominate. In the strict sense of the term, lime is calcium oxide or calcium hydroxide. It is also the name of the natural mineral (native lime) CaO which occurs as a product of coal seam fires and in altered limestonexenoliths in volcanic ejecta.[1] The word "lime" originates with its earliest use as building mortar and has the sense of "sticking or adhering".

The rocks and minerals from which these materials are derived, typically limestone or chalk, are composed primarily of calcium carbonate. They may be cut, crushed or pulverized and chemically altered. "Burning" (calcination) converts them into the highly caustic material "quicklime" (calcium oxide, CaO) and, through subsequent addition of water, into the less caustic (but still strongly alkaline) "slaked lime" or "hydrated lime" (calcium hydroxide, $Ca(OH)_2$), the process of which is called "slaking of lime". Lime kilns are the kilns used for lime burning and slaking.

When the term is encountered in an agricultural context, it usually refers to agricultural lime, which is crushed limestone, not a product of a lime kiln. Otherwise it most commonly means slaked lime, as the more dangerous form is usually described more specifically as quicklime or "burnt lime".

Figure.1.3 Lime Powder

1.3.1 PHYSICAL PROPERTIES OF LIME POWDER:

PHYSICAL APPEARANCE	WHITE POWDER
SPECIFIC GRAVITY	2.2
pH(1%solution)	12.4
SOLUBILITY@20°C(68°F)	0.165 g/100ml water
BULK DENSITY	2210.5kg/m^3(138 lb/ft^3)

1.3.2 CHEMICAL PROPERTIES OF LIME POWDER:

CHEMICAL PROPERTIES	
Chemically, both limestone and marbles are siliceous calcium carbonate rocks.	
Lime (CaO)	38-42%
Silica (SiO2)	20-25%
Alumina (Al2O3)	2-4%
Other Oxides like Na, Mg	1.5 to 2.5%
Loss On Ignition (LOI)	30-32%

1.4 AIM

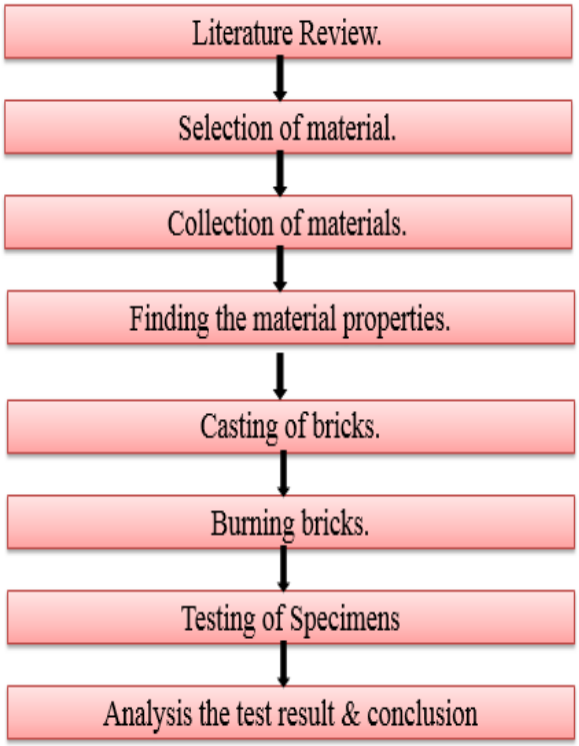
To Experimental study on light weight bricks using perlite and lime materials**.**

1.5 SCOPE :

- ❖To reduce the weight of the bricks.
- ❖Floating bricks.
- ❖To avoid the accidents of fire industries.

2.METHODOLOGY:

2.1 FLOWCHART:



The methodology of the project involves collection of literature and necessary documents required for the experimental work. After the sufficient documents are collected, the materials required for the experimental work is collected, and tested for its originality against the project specifications. When the materials satisfy the project specifications, the specimens (bricks) are to be casted and are to be burned under normal bricks conditions.

When the materials are burned, the bricks are tested for their compression strength, and the water absorption test.

3. MATERIAL COLLECTION AND TESTING

3.1 MATERIAL PROPERTIES:

3.1.1 Specific gravity test of Expanded perlite:

The empty specific gravity bottle designed and was taken as (w1).The bottle was filled with perlite and the weight is taken as (w2).The specific gravity bottle was filled with perlite and water weighed which was

taken as (w3).Roll the bottle in the incline position until no further air bubble rise to the surface. Fill the bottle to the top with water and weight (w4).

Specific gravity of EPA = $\left(\frac{W2-W1}{(W2-W1)-(W3-W4)}\right)$

Figure:3.1.specific gravity test

3.1Specific gravity of Expanded Perlite

Description	Weight in g		
	Trial I	Trial II	Trial III
Weight of empty mould (W_1)	611	611	611
Weight of mould +EPA (W_2)	630	620	629
Weight of mould + EPA +water (W_3)	1450	1468	1465
Weight of mould + water (W_4)	1510	1510	1510

4.EXPERIMENTAL PROGRAM:

This Indian Standard was adopted by the Indian Standards Institution on 17 November 1968, after the draft finalized by the Flooring and Plastering Sectional Committee had been approved by the Civil Engineering Division Council. These bricks are made of raw materials, such as clay or shale of suitable composition with low lime and iron content, felspar, flint or sand, and vitrified at high temperatures in ceramic kilns. These bricks are-designed primarily for use in chemical and allied industries and are normally used with chemical resistant mortars.

This standard covers the requirements for bricks intended for use where minimum absorption is required and thermal shock and alkali resistance are not important service factors. In the formulation of this standard due weightage has been given to international co-ordination among the standards and practices prevailing in different countries in addition to relating it to the practices in the field in this country.

It is necessary to Check the quality of brick before using it in any construction activities. There are some field tests that we can conducting the field in order to check the quality of bricks. A Brick is generally subjected to the following tests to find for the Construction work. These tests are as follows.

Compression Test.

4.1.COMPRESSION TEST:

1. Unevenness observed in the bed faces of bricks is removed to provide two smooth and parallel faces by grinding. It is immersed in water at room temperature for 24 h.
2. The specimen is then removed and any surplus moisture is drained out at room

temperature. The frog and all voids in the bed face is filled with cement mortar (1 cement, clean coarse sand of grade 3 mm and down). It is stored under the damp jute bags for 24 h followed by immersion in clean water for 3 days.

3. The specimen is placed with flat faces horizontal, and mortar filled face facing upwards between two 3 ply plywood sheets each of 3 mm thickness and carefully centered between plates of testing machine.

4. Load is applied axially at a uniform rate of 14 N/mm^2 per minute till failure occurs. The maximum load at failure is noted down. The load at failure is considered the maximum load at which the specimen fails to produce any further increase in the indicator reading on the testing machine.

Figure4.1.Compression Test

$$\text{Compressive strength}(N/mm^2) = \frac{\text{Maximum load at failure in N}}{\text{Avg. area of the bed faces in } mm^2}$$

BRICK RATIO	TRIAL I	TRIAL II	TRIAL III	Avg Compressive Strength (N/mm^2)
CONVENTIONAL BRICK	8.30	7.70	7.8	7.93
B1 (70,30)	3.37	3.56	3.31	3.41
B2 (75,25)	3.52	3.42	3.30	3.41
B3 (80,20)	3.44	3.3	3.4	3.38
B4 (85,15)	2.79	2.71	2.91	2.80

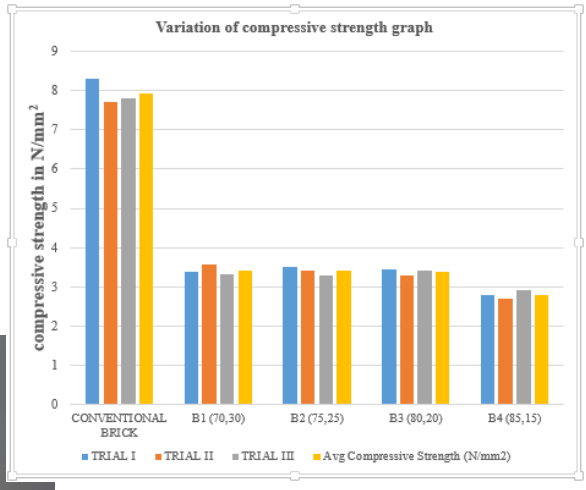


Figure.4.1.Graph for compression strength

5.CONCLUSION:

This work effectively converts perlite into useful building materials like building bricks and floor interlocks which can effectively reduce the self weight or dead load and further decreases the problem of fire industries accidents in the society. Rather than the expanded perlite going into the landfill or incinerators it can be used as construction materials at a much lower cost after undergoing certain specific processing. From the compression testing results we come to know that expanded perlite material when effectively mixed

lime gives the 3.3 N/mm^2 compressive strength. This brick is floating into the water.

Acknowledgement

We wish to express our sincere thanks to Dr. S.Shahul Hameed. ME., Ph.D., Head of the Department of Civil Engineering, for his kind advice and constant encouragement. We Record my deep sense of thanks to Project coordinator and always my beloved Guide Mr. L.Arunraja. M.E., Department of Civil Engineering, for his constant help and creative ideas over the period of project work. We would like to extend our warmest thanks to all our Staff members for helping us in this venture. Unflinching support and encouragement from the members of my family, friends in P.S.R ENGINEERING COLLEGE helped us a long way to complete our project work. We must thank them all from depths of our heart.

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Study Of Strength Properties Of Concrete By Partial Replacement Of Fine Aggregate By Steel Slag

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Abstract- *In this paper, study of strength of concrete by partially replacing fine aggregate with steel slag. This study is done because of scarcity of fine aggregate and it also reduces waste disposal. In this compressive strength, flexural strength and tensile strength. Steel slag were added in varying percentages of 10%, 20% and 30%. Six cubes were casted for compressive strength of concrete at age of 7 days and 28 days. Three cylinder and prism were casted for split tensile and flexural strength of concrete at age of 28 days. The results indicated that use of steel slag reduces usage of natural fine aggregates, waste disposal and also gives strength.*

Keywords- **steel slag, fine aggregate, flexural, tensile, compressive**

I. INTRODUCTION

Steel slag is a by-product obtained from melting steel scrap from the impurities and fluxing agents, which form the liquid slag floating over the liquid steel in arc or induction furnaces or other melting units. Waste management is one of the most common and challenging problem in the world. The steel making industry has generated substantial solid waste. Steel slag is a residue obtained from steel making operaion. Now-a-days using waste as an alternative for concrete mixtures. This is very helpful to reduce waste disposal, its area and environment pollution.

SALIENT FEATURES OF THE PROJECT:

- Reduces waste disposal
- Reduces usage of fine aggregate
- Low cost
- Increased strength
- Reliable quality

II. EXPERIMENTAL INVESTIGATION

Properties of materials used in this investigation were determined by testing of cement, fine and coarse aggregate. The detail of the test results are given below.

Cement:

Type	:	OPC
Specific gravity	:	3.15
Fineness of cement	:	2%
Consistency	:	26%

Fine aggregate:

Specific gravity	:	2.61

Coarse aggregate:

Specific gravity	:	2.67

Steel slag:

Specific gravity	:	2.93

Table 1: Mix proportion for M30 grade concrete

Material for M30 concrete	Weight of materials for 1m^3 concrete
OPC	438 Kg
Fine aggregate	690.6 Kg
Coarse aggregate	1063.72 Kg
water	197 litres
Water cement ratio	0.5

III. RESULTS SLUMP VALUES FOR MIXES WITH ADDITION OF STEEL SLAG

Table 2: Slump values for various mixes

Grade of concrete	% of steel slag	Slump value
M30	0%	75mm
	10%	70mm
	20%	63mm
	30%	55mm

COMPACTION FACTOR FOR VARIOUS MIXES

Table 3: Compaction factor values

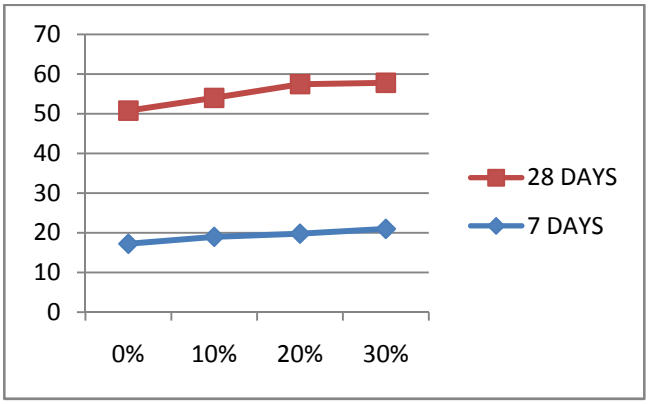
Grade of concrete	% of steel slag	Compaction factor
M30	0	0.81
	10	0.84
	20	0.85
	30	0.83

COMPRESSIVE STRENGTH FOR VARIOUS MIXES

Table 4 : Comparison of conventional mix vs steel slag mix

Grade of concrete	% of steel slag	Compressive strength (N/mm^2)	
		7 days	28 days
M30	0	17.23	33.55
	10	18.99	35
	20	19.78	37.67
	30	21	39.4

Graph 1: Compressive strength of conventional mix vs % of steel slag



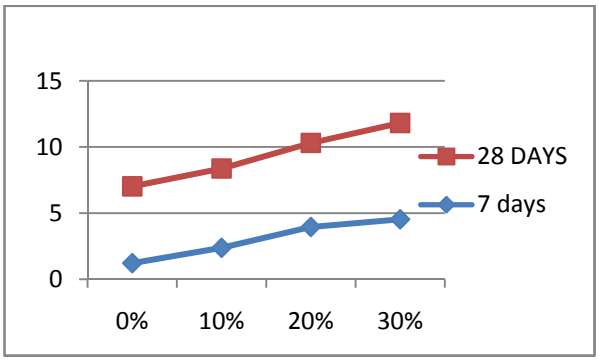
SPLIT TENSILE STRENGTH FOR VARIOUS MIXES

Table 5: Split tensile strength of conventional mix vs steel slag mix

Grade of concrete	% of steel slag	Split tensile strength (N/mm^2)	
		7 days	28 days
	0	1.22	5.8
	10	2.38	5.99

M30	20	3.96	6.35
	30	4.54	7.28

Graph 2: Split tensile strength of conventional mix vs %of steel slag

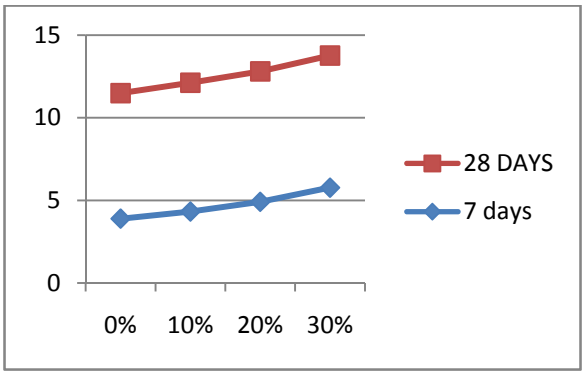


FLEXURAL STRENGTH FOR VARIOUS MIXES

Table 6: Flexural strength of conventional mix vs steel slag mix

Grade of concrete	**% of steel slag**	**Flexural strength (N/mm^2)**	
		7 days	**28 days**
M30	0	3.89	7.6
	10	4.32	7.8
	20	4.91	7.9
	30	5.77	8.0

Graph 3: Flexural strength of conventional mix vs % of steel slag



IV.CONCLUSION

The following conclusions are presented based on experimental results from the present investigation.

1. The compressive strength values are increase slightly with increasing of steel slag.
2. The split tensile strength values are increasing slightly with increase of steel slag.
3. From the result of compressive strength test, split tensile test and flexure test strength of M30 grade concrete increases by partially adding steel slag.

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EXPERIMENTAL STUDY ON MANUFACTURING BRICKS BY USING MARBLE SLUDGE POWDER FOR ACID RESISTANCE TEST

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Abstract

Brick is one of the most common masonry units as a building material due to its properties. The rapid growth in today's construction industry has obliged the civil engineers in searching for more efficient and durable alternatives far beyond the limitations of the conventional brick production. Many attempts have been made to incorporate wastes into the production of bricks and recycling such wastes by incorporating them into building materials is a practical solution for pollution problem. So the proposed system is to the invention of waste marble sludge powder and bottom ash as the replacement of clay bricks regarding the strength and durability studies. In our project, totally 100 number of bricks are to be casted with partial replacement of marble sludge powder. The percentage of replacement is carried out in this work as 0%, 5%, 10%, 15% and 20% by total volume. The strength and durability test of bricks is to be calculated.

Keywords: Thermal resistant, Marble Sludge powder, compressive strength, Minimum percentage

I. INTRODUCTION

Brick is one of the oldest manufactured building materials in the world. As early as 14,000 BC, hand-moulded and sun-dried clay bricks were found in the lower layers of Nile deposits in the Egypt. Clay was also ancient Mesopotamia's most important raw material and most buildings during that time were made of clay bricks. The earliest use of bricks recorded was the ancient city of Ur (modern Iraq) that was built with mud bricks around 4,000 BC and the early walls of Jericho around 8,000 BC. Starting from 5,000 BC, the knowledge of preserving clay bricks by firing has been documented. The fired bricks were further developed as archaeological traces discovered in early civilizations, such as the Euphrates, the Tigris and the Indus that used both fired and unfired bricks. The Romans used the fired bricks and were responsible for their introduction and use in England. However, the brick making craft declined following the departure of the Romans from Britain in 412 AD and was only revived later by Flemish brick makers. The development of different types of bricks continued in most countries in the world and bricks were part of the cargo of the First Fleet to Australia, along with brick moulds and a skilled brick maker. Bricks have continuously been used by most cultures throughout the ages for buildings due to their outstanding physical and engineering properties. Brick is one of the most demanding masonry units. It has the widest range of products, with its unlimited assortment of patterns, textures and colours.IN1996, the industry produced 300 million bricks in Victoria, which were about 55% of the potential production of the facilities available. The export markets included Japan, New Zealand, the Middle East and other Asian countries. This is equivalent to an annual turnover of 130 million dollars. Brick is durable and has developed with time. It remains highly competitive, technically and economically, with other systems of structure and field. The main raw material for bricks is clay besides clayey soils, soft slate and shale, which are usually obtained from open pits with the attendance of disruption of drainage, vegetation and wildlife habitat. Clays used for brick making vary broadly in their composition and are dependent on the locality from which the soil originates. Different proportions of clays are composed mainly of silica, alumina, lime, iron, manganese, sulphur and phosphates.

II.LITERATURE VIEW

1. Dr.C.Anbalagan et al., 2016 Majority of the people prefer burnt bricks for the construction purpose which emits nearly about 1 ton of CO2. The usage of environmental friendly, structurally sound and in expensive materials was used in the ancient centuries. The stabilized bricks are the one which have a low embodied energy of 0.42 MJ/kg and low carbon foot print. This paper presents the strength of the

bricks by using different recyclable materials like coconut fiber, granite waste and egg shell powder.

2. L.M. Federico, S.E. Chidiac, R.G. Drysdale et al., 2005

Fired clay bricks are produced when clay particles bond to one another at high temperatures,

Forming a glassy material, which, upon cooling, displays high strength and durability properties. High temperatures required to melt SiO2 mean high energy cost associated with brick

In addition to cost, challenges facing the modern brick industry include shortages of raw material and environmental impacts of production. The feasibility of using waste material as a brick body was investigated, where several possible waste additives, including slag, biological waste, and waste container glass, were considered. A literature review was conducted in order to assimilate past work and experimental results. The results of several testing programs were compared and the feasibility of further work in the addition of waste additives to bricks was

Its soda content, amorphous glassy structure, and availability, waste glass was determined to be a feasible option for addition. The specimens with glass additions exhibited an increase in compressive and flexural strength, a decrease in the initial rate of absorption, and an increase in firing shrinkage. The determination of feasibility of adding slag or biological waste to bricks was hindered by a lack of comparable data; however, the limited comparison available suggested the necessity for additional, directly comparable testing programs. As a result, an experimental program was developed to investigate potential benefits in terms of strength, absorption, and durability of bricks associated with the addition of waste glass, as well as economic and environmental gains as a result of the process.

3. A. Venkatesan et al., 2015 Based on experimental investigations concerning compressive strength and water absorption of the Brick, the following results were obtained, Compressive strength decreases on increase in percentage of wood ash as compare to charcoal brick. The different percentage of wood ash and charcoal (5%, 10% & 15%) are added with cement and sand. The compressive strength for both bricks are decreased. In that charcoal brick has maximum compressive strength ie.,(11.07 N/mm2 for 15 % of charcoal) than wood ash brick (7.9 N/mm2 for 15% of wood ash).The water absorption for both the bricks are increases with percentage of (5%,10%,15%).In that the charcoal brick has less amount of water absorption ie.,(4.45% for 15% of charcoal) than wood ash brick(15.80% for 15% of wood ash).Thus from above study, this project concluded that, with the addition of charcoal in the cement and sand, the compressive strength of bricks increases and water absorption decreases than wood ash bricks.

4. Rania Hamza, Salah El-Haggar, Safwan Khedr et al., 2011 Marble and granite slurry cement bricks yield similar mechanical, in terms of compressive strength, and physical, in terms of density and absorption, properties. There is a positive effect of granite slurry on cement brick samples that reach its optimum at 10% slurry incorporation. Absorption is the major drawback of slurry incorporation in cement bricks according to the ASTM C55 where water absorption requirement is full filled only at Zero, 10 %, and 20% slurry samples for grade S. The accelerated hydration, endued by heating, compensated the detrimental effect of volumetric changes associated with temperature variation. Most cement brick samples, including the control, are of normal weight according to both the Egyptian specifications and ASTM C55.All cement brick samples tested in this study comply with the Egyptian code requirement for structural bricks. This is not true when compared to ASTM C55. Instead, 10% and 20%

5. Virendra Kumara at al., 2015 Granite sludge powder generates in processing activities of granite stone, such as cutting, polishing and finishing process. This contributes of about 30% wastage in these processes. As granite sludge powder is non- biodegradable waste, it has to be effectively disposed without creating environmental hazards. In our present study the objectives are to prepare Granite Sludge blocks of size230×110×70(mm) for varying mix proportions such as 20%, 30%, 40%, 50%,60%, and 70% for granite sludge powder and sand, by keeping lime 8% and gypsum 2% as constant. To find Mechanical properties such as Compressive Strength, Flexural strength and Water absorption, where maximum compressive Strength value for 7 days of 5.54 MPa, maximum flexural strength of 2.17 MPa And maximum breaking load 4.33kN was obtained for A3 block type. Water Absorption of granite sludge blocks increases with increase in addition of granite Sludge powder in mix proportions, yet it is in limit as per IS code specifications. Utilizing granite sludge powder for manufacturing of granite sludge masonry Blocks is one of efficient manner to minimize the disposal problems of granite

Sludge powder.

6. R.Nithiya ct al., 2016 Majority of the people prefer burnt bricks for the construction purpose which emits nearly about 1 ton of CO2.The usage of environmental friendly, structurally sound and in expensive materials was used in the ancient centuries. The stabilized bricks are the one which have a low embodied energy of 0.42 MJ/kg and low carbon foot print. This paper presents the strength of the bricks by using. Thus from above study, this project concluded that, with the addition of charcoal in the cement and sand, the compressive strength of bricks increases and water absorption decreases than wood ash bricks. Utilizing granite sludge powder for manufacturing of granite sludge masonry Blocks is one of efficient manner to minimize the disposal problems of granite Sludge powder.

III.METHODOLOGY

Data was collected from the study area, review of literature and secondary source of information. The main aim is to identify materials and check the parameter of materials using study. Material parameters are mainly used for design the mix as per code practices. Mix design can be calculated from the procedure for prepare the specimen. Brick will be Casted and burned. Finally specimen will be tested to get results.

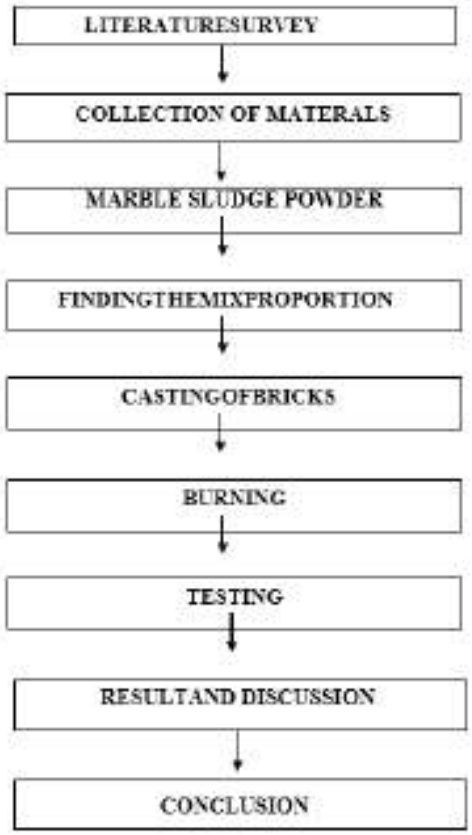

Fig 1 Methodology

IV.TESTING PROGRAM

1. MATERIALS

i) Marble sludge powder:

Marble is a metamorphic rock resulting from the transformation of pure lime stone. Marble sludge powder is an industrial waste containing heavy metals as constitutes. Chemically, marbles are crystalline rocks composed predominantly of calcite, dolomite or serpentine materials. The other mineral constituents vary from origin to origin.

ii) RED SOIL:

Red soil is a type of soil that develops in a warm, temperate, moist climate under deciduous or mixed forests and that have thin organic and organic-mineral layers overlying a yellowish-brown leached layer resting on an alluvial (see illuviation) red layer. Red soils generally derived from crystalline rock

iii) CLAY:

Clay is a fine-grained natural rock or **soil** material that combines one or more **clay** minerals with traces of metal oxides and organic matter. Geologic **clay** deposits are mostly composed of phyllosilicate minerals containing variable amounts of water trapped in the mineral structure.

iv) WATER:

Ordinary potable water

2. MIX DESIGN

Mix design for control specimen of bricks
(As per code IS3495-P(1)-1992) Methods of tests of burnt clay building bricks compressive strength of Clay brick can be determined.

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Adjustment is made according to IS code.

Sample	Sand (Kg)	Clay (Kg)	Marble sludge powder (Kg)	Water in % in weight
CS	2.7	0.3	-	10
S1	2.56	0.3	0.135	10
S2	2.43	0.3	0.27	10
S3	2.3	0.3	0.405	10
S4	2.16	0.3	0.54	10

Table 2: Mix design

3. MIX PROPTION

SAMPLE	MARBLE SLUDGE (%in vol.)
CS	0
S1	5
S2	10
S3	15
S4	20

Table 3: Mix Proportion

In order to know the best proportion of Marble sludge powder. To make 100 different test bricks of dimension 19x9x9cm. The different four proportions are as following

V.RESULTS AND DISCUSSIONS

1. Water Absorption Test

S. NO	sample	time (hrs)	Dry weight (kg)		Wet weight (kg)		LOSS IN WEIGHT IN (%)
			Trial 1	Trail 2	Trial 1	Trial 2	
1	CS	24	3.20	3.04	2.98	2.86	6.41
2	S1	24	2.88	2.85	2.67	2.63	7.6
3	S2	24	2.76	2.76	2.61	2.58	5.8
4	S3	24	2.95	2.86	2.70	2.67	6.4
5	S4	24	2.84	2.83	2.64	2.57	8.3

Table 1: Water Absorption Test

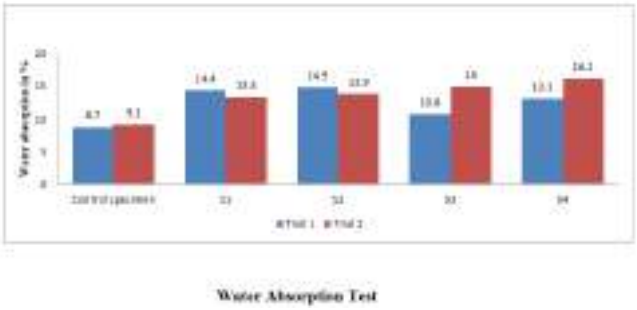

Fig: 1 Water Absorption Test

2. Acid Resistance Test

S. NO	sample	time (hrs)	Dry weight (kg)		Wet weight (kg)		LOSS IN WEIGHT IN (%)
			Trial 1	Trail 2	Trial 1	Trial 2	
1	CS	24	3.20	3.04	2.98	2.86	6.41
2	S1	24	2.88	2.85	2.67	2.63	7.6
3	S2	24	2.76	2.76	2.61	2.58	5.8
4	S3	24	2.95	2.86	2.70	2.67	6.4
5	S4	24	2.84	2.83	2.64	2.57	8.3

Table 2: Acid Resistance Test

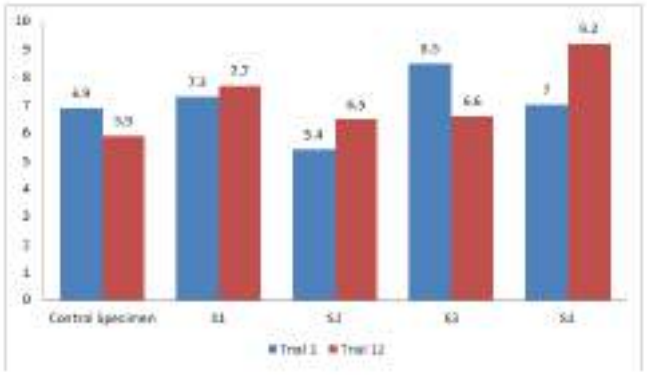

Fig: 2 Acid Resistance Test

VI.CONCLUSION

The following conclusions could be drawn from the present investigation.

- Marble sludge powder waste content up to 5%, 10%, 15%&20% by vol can be replaced in Sand mixture, without degrading their mechanical properties.
- The presence of marble sludge powder allow one to obtain a clay brick with better properties as the conventional clay brick at low temperatures as
- The normally used for brick products in the brick industry, resulting in energy saving and waste reduction.
- The incorporation of marble sludge powder in brick production anticipates safe for the health an environmentally friendly recycling products.
- Therefore, utilization of solid wastes has been encouraged as one of the most cost-effective alternative materials.
- That could be used in fired clay brick manufacturing.
- Recycling industrial and urban waste in fired clay brick is useful if the correct percentages were incorporated.
- Brick manufacturer will reduce the cost of raw materials, the usage of energy during firing and the improvement of the properties.

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An Experimental Investigation On Rheological Properties Of SCC Using Steel Scrap

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***Abstract*: *This project presents the experimental study on self-compacting concrete (SCC) with replacement of cement by various percentage of fly ash. The main objective is to be determine the workability, flow ability and passing ability on Self compacting concrete by partial replacement of cement by fly ash (20%, 25% and 30%) & steel scraps. The work involves making several types of SCC mixes. The Slump Cone, L-Box, J-Ring and V-Funnel test are carried out on fresh SCC. The Fresh concrete properties are determined. The result show that SCC with various percentage of fly ash (20%, 25% and 30%), steel scraps & super plasticizer is mixed with optimum SCC. After each mix preparation, all the mentioned tests are done and the values are determined*.

Keywords: *Steel scrap, fly ash, Fresh properties*

I. INTRODUCTION

Self-compacting concrete (SCC), is a concrete which flows by its own self weight. So it does not requires compaction at site or concrete plants. It has been developed in Japan to improve the durability and uniformity of concrete in 1988 by Okamura and Ozawa. The mix composition is chosen to satisfy all performance criteria for the concrete in both the fresh and hardened states. Self-compacting concrete is defined as the concrete which can be placed and compacted into every corner of formwork purely by means of its self-weight by eliminating the need of either external energy. To achieve this, fly ash and silica fume were used as mineral admixtures, and super plasticizers are used in mix as chemical admixtures for design of concrete. The main difference between conventional concrete to self - compacting concrete is the pore value in concrete mass i.e. highly eliminated pores. In this regards, mass of fine aggregate is typically equal or more compare to coarse aggregate. And selection of coarse aggregate size also gives impact on requirement of self-compacting.

There are many advantages of using SCC especially when the material cost is minimized which include

- Reducing the construction time and labour cost.
- Eliminating the need for vibration.
- Reducing noise pollution
- Improving the filling capacity of highly congested structural member.

A. Applications of Self-Compacting Concrete

- SCC can be used in precast industries.
- In complicated reinforcement positions.
- Construction element in high rise buildings.
- Marine structures.
- Reduced form work and equipment cost.
- Less man power.

B. Role of Fly ash as Mineral Admixture

Fly ash is a by-product which is generated from the combustion of coal in the thermal power plants. The increasing scarcity of raw materials and the urgent need to protect the environment against pollution has accentuated the significance of developing new building materials based on industrial waste generated from coal fired. Thermal power stations creating unmanageable disposal problems due to their potential to pollute the environment. The incorporation of one or more mineral admixtures/powdery materials having different morphology and grain size distribution can improve particle-packing density and reduce inter-particle friction and viscosity Fly ash, when used as a mineral admixture in concrete, improves deformability, Self- compatibility and stability of SCC.

II.OBJECTIVE

The objective of the present investigation is to study the effect of the addition of Fly ash in self-compacting concrete. To ensure the strength properties of self-compacting concrete with Scraps will be experimentally compared with nominal self-

compacting concrete. To investigate the workability characteristics, Fresh properties of Self-Compacting Concrete with Fly ash.

III.DEVELOPEMENT OF MIX DSIGN

The mix design of self-compacting concrete is a trial and error method. Many references available for mix proportioning of SCC. Here we use mix proportioning based on previous investigation strength data using Japanese method and also based EFNARC guidelines.

The concrete mix proportion was 1: 1.91: 1.72: 0.38 and water content was 178 lit/m3.

Table 1. Desired Mix Design

S. No	Items	Per m3 of concrete
1	Cement	378.12 kg
2	Fly ash	92.32 kg
3	Fine Aggregate	898.3 kg
4	Coarse Aggregate	809.5 kg
5	Water	178 L

IV.EXPERIMENTAL PROGRAMME

To study the fresh concrete properties of self-compacting concrete based on the parameters defining the fresh concrete. Many different test methods have been developed in attempt to characterize the property of Self-Compacting concrete.

Table 2. Permissible Limits for SCC

Testing Methods	Units	Typical Ranges	
		Minimum	Maximum
Slump Flow(Diameter)	Mm	660	800
Slump Flow(Time)	Sec	2	6
V-Funnel	Sec	6	12
L-Box	Mm	0.8	1.0
J-Ring	Mm	0	10

A. Filling Ability

1) Slump Flow test

The slump flow is used to assess the horizontal free flow of Self Compacting Concrete in the absence of obstruction. This method is based on the test method for determining the slump. The diameter of the concrete circle is a measure for the filling ability of concrete. This test gives good assessment on the filling ability of the concrete and some indication of resistance to segregation.

Fig.1 Slump Flow Test

2) V-Funnel test

The equipment consists of a V-shaped funnel, shown in Fig. The described V-funnel test is used to determine the filling ability (flow ability) of the concrete with a maximum aggregate size of 20mm. The funnel is filled with about 12 liters of concrete and the time taken for it to flow through the apparatus measured.

Fig.2 V-funnel Test

B. Passing ability

1) L-Box test

The test assesses the flow of the concrete, and also the extent to which it is subject to blocking by reinforcement. The apparatus is shown in Fig. The apparatus consists of a rectangular-section box in the shape of an 'L', with a vertical and horizontal section, separated by a moveable gate, in front of which vertical lengths of reinforcement bar are fitted.

The vertical section is filled with concrete, and then the gate lifted to let the concrete flow into the horizontal section. When the flow has stopped, the height of the concrete at the end of the horizontal section is expressed as a proportion of that remaining in the vertical section (H_2/H_1in the diagram). It indicates the slope of the concrete when at rest. This is an indication passing ability, or the

degree to which the passage of concrete through the bars is restricted.

The horizontal section of the box can be marked at 200mm and 400mm from the gate and the times taken to reach these points measured. These are known as the T_{20} and T_{40} times and are an indication for the filling ability. It assesses filling and passing ability of Self Compacting Concrete, and serious lack of stability (segregation) can be detected visually.

Fig.3 L-Box test

C. Segregation Resistance Test

1) V-Funnel at t-6 minutes test

V-funnel test at 6 minutes is used to measure the segregation resistance of the concrete. The funnel can be filled with concrete and left for 5 minutes to settle. If the concrete shows segregation then the flow time will increase significantly.

V.EXPERIMENTAL INVESTIGATION

Table .3 Test Results of fresh concrete

Testing Methods	Units	Workability Values				
		Permissible limits	SCC Nominal)	SP1 F20%	SP2 F25%	SP3 F30%
Slump Flow(Dia)	Mm	650-800	670	655	665	668
Slump Flow(Time)	Sec	2-5	3	4.30	3.40	3.10
V-Funnel	Sec	6-12	6	7	6	6
J-Ring	Mm	0-10	7	7.20	8.10	8.30
L-Box	Mm	0.8-1.0	0.86	0.91	0.89	0.87

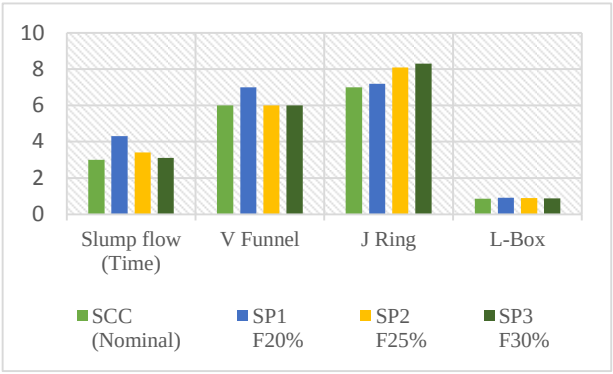

Fig.4 Workability values

VI.CONCLUSION

The SCC mix with the addition of 2% Steel Scraps satisfies the workability limits hardly. The Addition of 20%, 25%, 30% of Fly ash and 2% of steel scraps gives good results for flowing and passing ability. Hence further addition of fly ash may not satisfy the limits EFNARC Guide lines. The waste Steel scraps used in self-compacting concrete which is now proved to be enhancing the Fresh properties of SCC.

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Construction Project Cost Management Aid of Software Application

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Abstract— *The main objective of the project is to do effective management in the cost for the construction activities of an apartment building located at Sankarankovil near Tirunelveli. This study is to be managing the issues due to unexpected delays with very optimum cost. The project management tool used is Microsoft Project 2013. Microsoft Project is used to do the planning, scheduling, resource allocation and costing for the construction activities in this project. The Gantt chart was drawn based on the sequence of activities in the construction site with the corresponding duration and it also shows the resource allocation for the activities which helps in the calculation of the estimation. The resource sheet helps in the determination of the total estimation for the completion of apartment building. After the listing of activities and allocation of resources and scheduling, estimation is done by both the methods i.e., manually and by using Microsoft Project software and they are compared. By using this software, the total estimation of the building was resulted based on the control of duration.*

Keywords— effective management; delays; costing; Microsoft Project; Gantt chart; resource allocation; efficient;

I. INTRODUCTION

Project is a non-repetitive one-time venture to build something of lasting value, amidst formidable uncertainties to be overcome. It is a job that has a beginning and an end (time), a specified outcome (scope), at started level of quality (performance) and a budget (cost). Organization performs work. Project management is an art and science of mobilizing and managing people, material, equipment and money to complete the assign project of work on time within the budgeted cost and by specified technical performance standards. There is always a dynamics link between these thee forces. A project is essentially a set of operations or activities to be completed in logical order. In project management, a schedule is a listing of a project's milestones, activities, and deliverables, usually with intended start and finish dates. Those items are often estimated by other information included in the project schedule of resource allocation, budget, task duration, and linkages of dependencies and scheduled events.

The key objective of the construction project management is to complete the project with the allotted time, resources and within the budgeted cost. Project gets starts at the right way but as it proceeds further, gets off the track. The project leads to some delays in the construction site which can be managed by additional resource allocations and appropriation of overtimes for the labours thereby resulting in the uncertainty of cost. Some of the delays that makes the MS Project estimation modified when compare to the manual estimation are shown.

a) Unexpected recess
b) Weather conditions
c) Labour Strike,
d) Changes made to the existing design etc...

The resource allocation is made in the resource sheet and their rates are accustomed with each resource. They can be people, equipment, facilities, funding, or anything else. The rates for the every activity are set as per the requirements of the resources and their estimation is calculated. Estimation is an inherent aspect of project management. Project estimation techniques are critical survival tools for predicting when a project will finish and how much it will cost. Estimation is a part of the planning process and it is a technique used to predict future values for variables such as cost and duration. An “estimate” is fundamentally an educated assessment of developing the project management plan includes estimating activity resources, task durations, and costs, it’s imperative to use proven and sound estimation techniques for a reliable project plan. MS Project

helps in calculating an "overhead" task such as weekly project management activities. Estimation is calculated by adopting both resource allocation and rates liable in the resource sheet.

II. Literature Review

A. *Sambasivan. M & Soon. Y* (2013), discussed that,

The problem of delays in the construction industry is a global phenomenon and the construction industry in Malaysia is no exception. The main purpose of this study is to identify the delay factors and their impact (effect) on project completion. Earlier studies either considered the causes or the effects of project delays, separately. It also aids to identify the delay factors and the effect on the project completion by doing a case study in ongoing projects. The delays in construction industry have many after effects among which the main are time extension, cost overrun, disputes, arbitrations and litigations. The main intent of this study is to identify the delays that result in cost extension factors for project completion. By analyzing the reasons for delay, possible recommendations are given. This study takes an integrated approach and attempts to analyze the impact of specific causes on specific effects. The major effects of delay are cost impact, reduced labour productivity, postponement in work, change in labour allocation etc. Not all delays can be rectified, but few of them can be overcome by improving management responsibilities.

B. Sandip *Pawar et al., (2012) contended that,*

The project management technique of planning and scheduling using tools and devices are helpful in comparing the project with stipulated cost, time and quality. Resource tracking, Minimize the uncertainty and Cost Effectiveness is focused in this project. . Earlier studies have mostly emphasized on the major causes or the effects of project delays. The delays which are caused solely by the contractor or its suppliers are called inexcusable delays. The software tool used for planning and scheduling is Primavera project planner enterprise for construction. The objective of maximizing the efficiency of the project strategy with respect to cost and time has to be balanced against the risks associated with new methods of working and the overall quality of the finished deliverables. The study covers three case studies of the process of planning, scheduling the activities and monitoring. A general re sequencing model had been proposed to overcome the delay factor from the critical area, to minimize the delay of the construction and to reduce the time, cost and it also helpful to concentrate on the major areas in the project. Resource planning is one aspect, which decides the systematic execution of the project at worksite. . It helps to plan and evaluate the resources for the Construction of the building project. This study also compares the cost variation due to the delay of the project and re scheduling the project by crashing process

III. Controling of Delays

The cost can be affected mainly due to delays in the project due to various reasons. The causes for the delays can be indentified and are listed below.

Causes for the delay

1. Delays in contractor's payments
2. Shortage of material in construction
3. Change in material
4. The weather condition
5. Shortage of manpower (skilled, semi-skilled and unskilled labour)
6. Frequent change of staffs
7. Poor site management
8. Improper management of the engineers
9. Unexpected holidays

Some of the delays are delay in submission of drawings, space constraints, and delay in payment by client, delay in material supply and local problems like strikes.

Delays in the project

In this construction project, the cost issues are due to unexpected holidays and shortage of resources. The unexpected holidays are listed below.

1. May Day
2. Pooja holidays
3. Diwali holidays
4. Chief Minister death
5. Demonetarization
6. Pongal holidays
7. New Year holidays

The calendar is set in the MS Project with considering the delays. The delays can be controlled by conferring the overtimes for the labours and also giving additional resources to complete the project within the scheduled time. The holidays are compensated by giving the overtime to the labours so that the scheduling can be controlled within the limited time without any delay to the customers. The overtime is given for the Sundays after the long delay due to the demonetarization. The problem with the

material deficiencies are control by exchanging the activities having the enough materials and equipment.

The holidays that are not included in the manual scheduling are shown below as in the MS project.

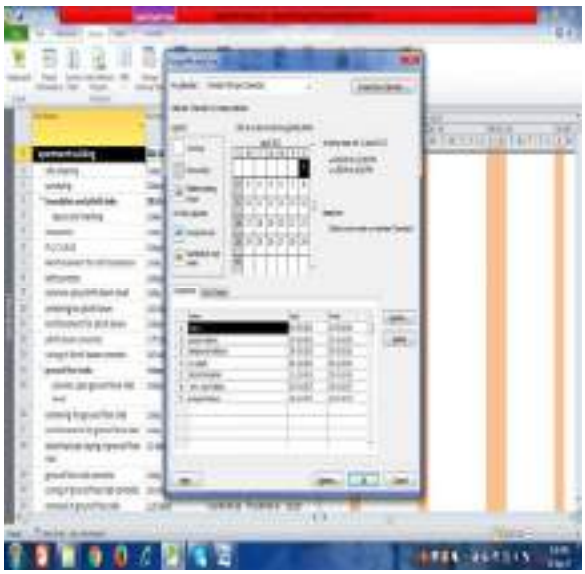

Fig. 1 Exceptions of working days

The overtime on the Sundays are shown below as in the Ms Project.

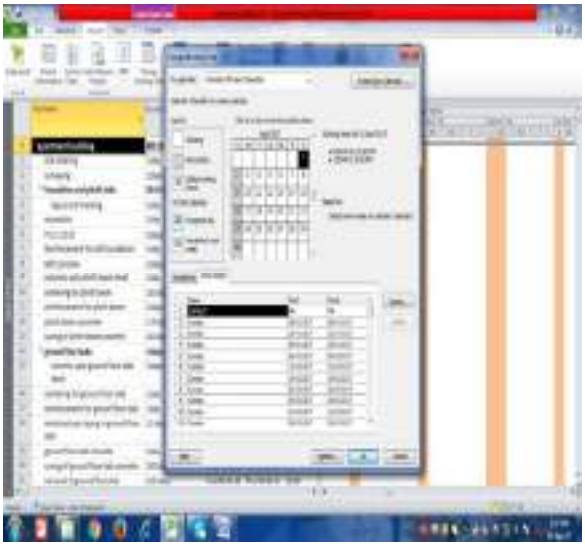

Fig. 2 Overtime days

In the overtime days like Sundays the same working is allotted (from 8 am to 5 pm). These overtime days requires additional resources to complete the project. So that the cost can be increase due to the rate increasing for the additional resources and delay for the labours who are present on the overtime days. The manual estimation is done by not considering the unexpected delays. So the cost would be lower when compare to the MS Project estimation.

IV.RESOURCE SHEET

The resource sheet helps in calculating the rates for each resource as per their quantity.

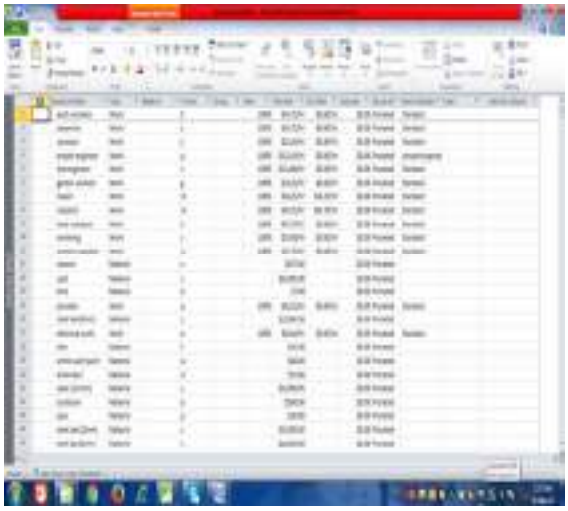

Fig. 3 Rates for the resources(contd.)

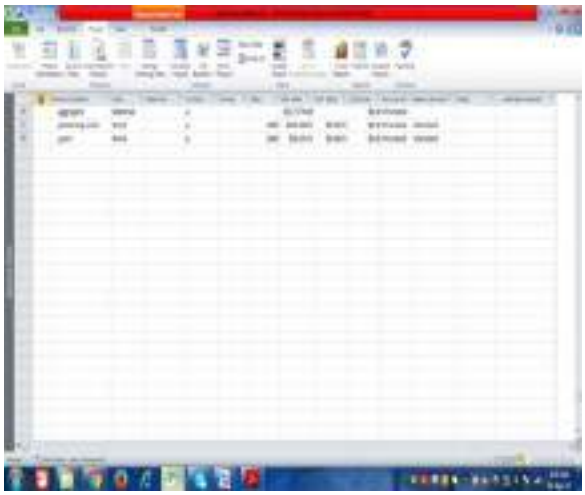

Fig. 4 Rates for the Resources

These resources and their rates are imported in the resources of the every activity. By allotting the resource and duration of every activity, the estimation is calculated.

V. MANUAL ESIMATION

The manual estimation was done by using approximate and estimate method. It is then compared with the estimation done by using MS Project and the results are discussed.

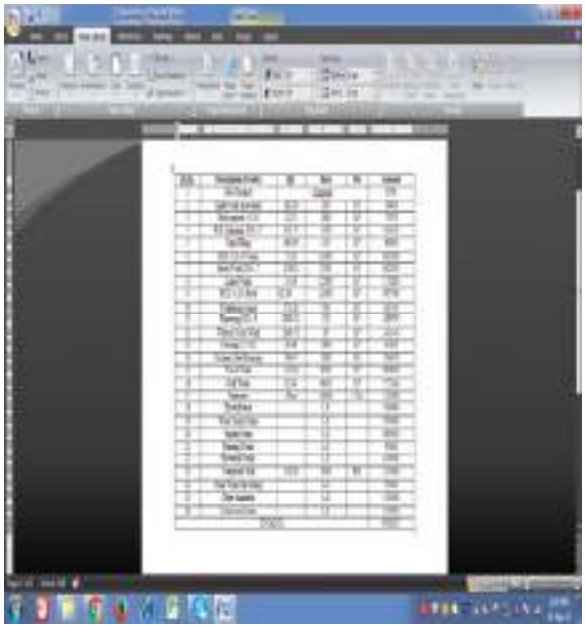

Fig. 5 Manual Estimation

VI ALLOCATION OF RESOURCES

Resources are required to carry out the project tasks. They can be people, equipment, facilities, funding, or anything else. The lack of a resource will therefore be a constraint on the completion of the project activity. Allocation of limited resources is based on the priority given to each of the project activities. The resources are allocated to every activity as per the requirements for the activity. The resources may be either material or workmanship or both. The resources that are included in the resource sheet are only being allowed to give resources to the activity. The rates for the every activity are set as per the requirements of the resources and their estimation is calculated. The resources that are allocated to every activity are shown in the Gantt chart for every activity. The allocated resources are not shown in the critical task. Here there is an example for the resources and rates of the activity which shows the Gantt chart having the resources and rates for the ground floor slab concrete.

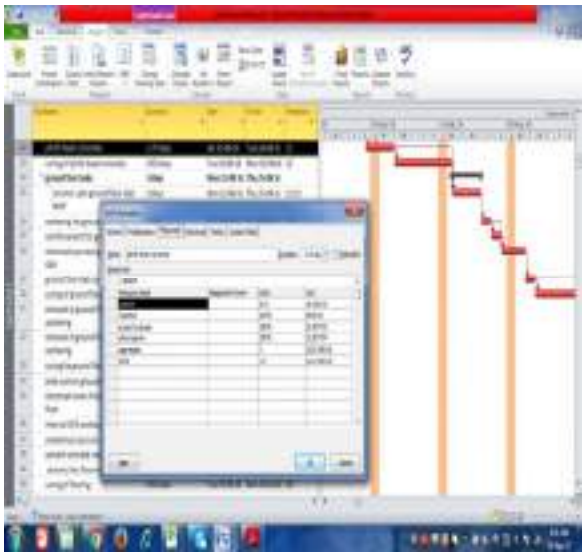

Fig. 6 Allocations of Resources for critical activity

Critical activity does not show the resources on the Gantt chart. With the help of these resources for the every activity, estimation is calculated.

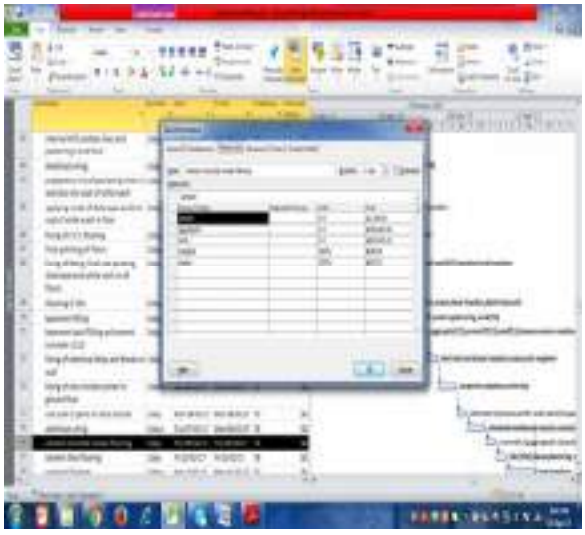

Fig.7 Resource Allocations for non-critical activity

Non Critical activity does show the resources on the Gantt chart. With the help of these resources for the every activity, estimation is calculated.

VII. MICROSOFTT PROJECT ESTIMATION

In MS Project, estimation is done by using the rates of the resources allocated for every separate activity. The total estimation is depends on both the duration of the activity and the overtime rates. The results for the MS Project are shown below for some of the activities.

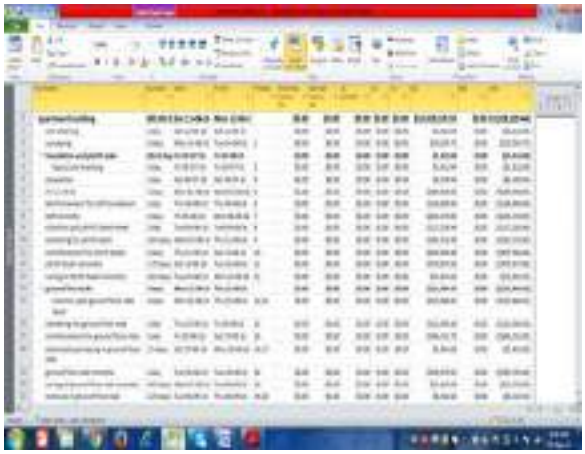

Fig.8 Estimation (contd.)

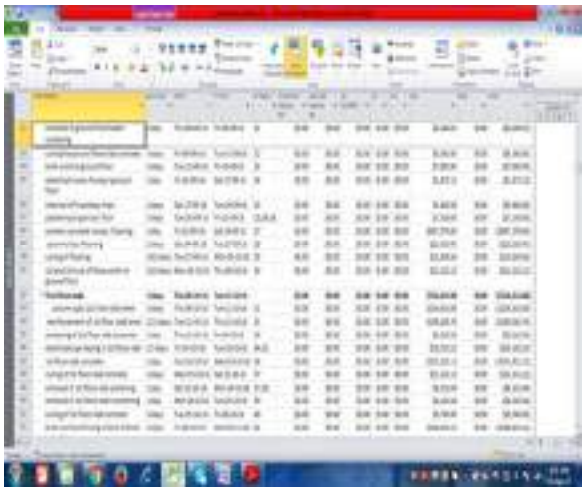

Fig.9 Estimation (contd.)

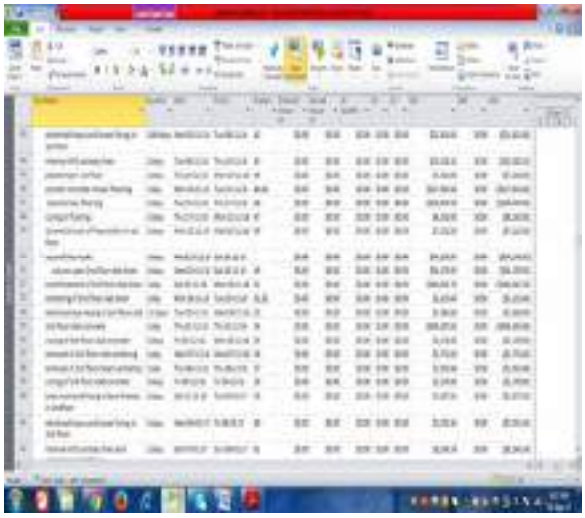

Fig. 10 Estimation (contd.)

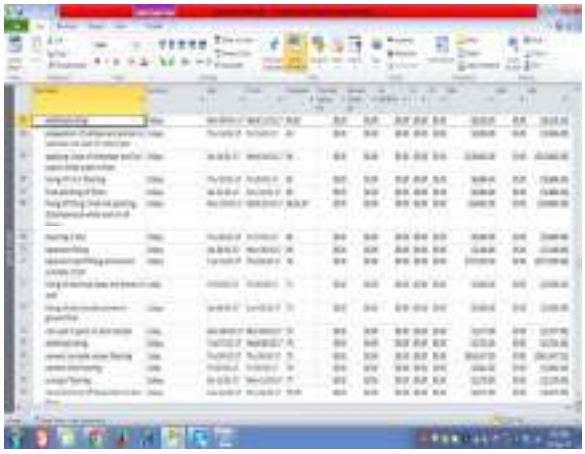

Fig.11 Estimation (contd.)

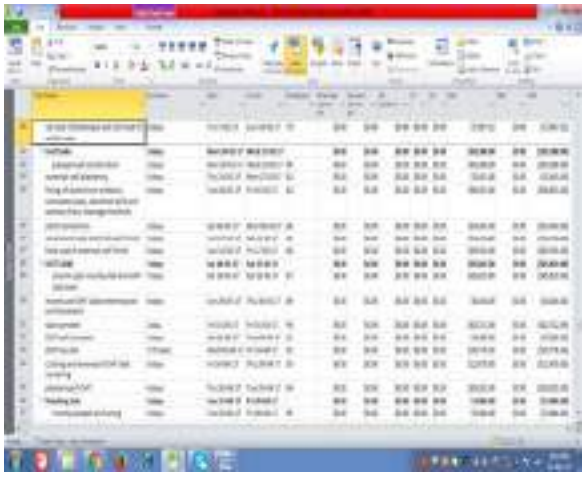

Fig.12 Estimation (contd.)

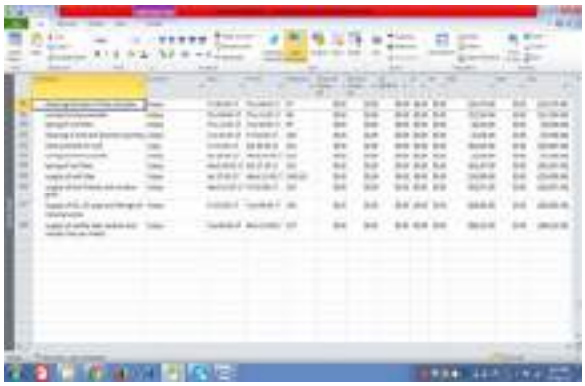

Fig.13 Estimation.

The estimation derived from MS Project will be further higher when compare to the manual estimation due to the management of delay using additional recourses and overtime.

VIII CONCLUTION

BASED ON BOTH THE METHODS (MANUAL AND MS PROJECT) OF ESTIMATION, THE FOLLOWING CONCLUSIONS ARE ARRIVED.

The delay causes some of the issues in the construction site. It is controlled by allotting the additional resources and overtimes. This increases the cost of the project after tracking higher than the estimated cost before tracking. Both the estimation are compared which showing that the estimation calculated by using MS Project is higher because the rates includes the management of delay by increasing the recourses and overtime to overcome the issues of issues. The project is completed with both critical and non critical paths. The tracking of the project is done from 11.06.2016 to 30.03.2017. The remaining portion of the overheat tank are to be complete and these can also be tracked in this project. The overall estimation calculated before tracking is Rs. 95, 62,837. This does not include the amount for the overtime and extra resources. The overall estimation calculated after tracking by using Microsoft project is Rs.1, 00, 28,189. This includes the overtime cost and additional resources cost. The time of the activity includes the weekly leave i.e. Sunday. Other unexpected leaves are not included in the manual scheduling. On this comparison between the manual and software methods of estimation, it is concluded that "Computer Aided Scheduling" is most efficient and time saving one and also makes the project, cost effective with Proper Planning.

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We wish to thank our guide **Mr. S. ASHOK MANIKANDAN M.E** for abiding interest in fastening the steady progress of our project.

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THERMAL RESISTANT BRICK

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Abstract

Brick is one of the most common masonry units as a building material due to its properties. The rapid growth in today's construction industry has obliged the civil engineers in searching for more efficient and durable alternatives far beyond the limitations of the conventional brick production. Many attempts have been made to incorporate wastes into the production of bricks and recycling such wastes by incorporating them into building materials is a practical solution for pollution problem. So the proposed system is to the invention of waste marble sludge powder and bottom ash as the replacement of clay bricks regarding the strength and durability studies. In our project, totally 100 number of bricks are to be casted with partial replacement of marble sludge powder. The percentage of replacement is carried out in this work as 0%, 5%, 10%, 15% and 20% by total volume. The strength and durability test of bricks is to be calculated.

Keywords: Thermal resistant, Marble Sludge powder, compressive strength, Minimum percentage

I. INTRODUCTION

Brick is one of the oldest manufactured building materials in the world. As early as 14,000 BC, hand-moulded and sun-dried clay bricks were found in the lower layers of Nile deposits in the Egypt. Clay was also ancient Mesopotamia's most important raw material and most buildings during that time were made of clay bricks. The earliest use of bricks recorded was the ancient city of Ur (modern Iraq) that was built with mud bricks around 4,000 BC and the early walls of Jericho around 8,000 BC. Starting from 5,000 BC, the knowledge of preserving clay bricks by firing has been documented. The fired bricks were further developed as archaeological traces discovered in early civilizations, such as the Euphrates, the Tigris and the Indus that used both fired and unfired bricks. The Romans used the fired bricks and were responsible for their introduction and use in England. However, the brick making craft declined following the departure of the Romans from Britain in 412 AD and was only revived later by Flemish brick makers. The development of different types of bricks continued in most countries in the world and bricks were part of the cargo of the First Fleet to Australia, along with brick moulds and a skilled brick maker. Bricks have continuously been used by most cultures throughout the ages for buildings due to their outstanding physical and engineering properties. Brick is one of the most demanding masonry units. It has the widest range of products, with its unlimited assortment of patterns, textures and colours.IN1996, the industry produced 300 million bricks in Victoria, which were about 55% of the potential production of the facilities available. The export markets included Japan, New Zealand, the Middle East and other Asian countries. This is equivalent to an annual turnover of 130 million dollars. Brick is durable and has developed with time. It remains highly competitive, technically and economically, with other systems of structure and field. The main raw material for bricks is clay besides clayey soils, soft slate and shale, which are usually obtained from open pits with the attendance of disruption of drainage, vegetation and wildlife habitat. Clays used for brick making vary broadly in their composition and are dependent on the locality from which the soil originates. Different proportions of clays are composed mainly of silica, alumina, lime, iron, manganese, sulphur and phosphates.

II.LITERATURE VIEW

1. Dr.C.Anbalagan et al., 2016 Majority of the people prefer burnt bricks for the construction purpose which emits nearly about 1 ton of CO2. The usage of environmental friendly, structurally sound and in expensive materials was used in the ancient centuries. The stabilized bricks are the one which have a low embodied energy of 0.42 MJ/kg and low carbon foot print. This paper presents the strength of the bricks by using different recyclable materials like coconut fiber, granite waste and egg shell powder.

2. L.M. Federico, S.E. Chidiac, R.G. Drysdale et al., 2005 Fired clay bricks are produced when clay particles bond to one another at high temperatures.

Forming a glassy material, which, upon cooling, displays high strength and durability properties. High temperatures required to melt SiO2 mean high energy cost associated with brick

In addition to cost, challenges facing the modern brick industry include shortages of raw material and environmental impacts of production. The feasibility of using waste material as a brick body was investigated, where several possible waste additives, including slag, biological waste, and waste container glass, were considered. A literature review was conducted in order to assimilate past work and experimental results. The results of several testing programs were compared and the feasibility of further work in the addition of waste additives to bricks was

Its soda content, amorphous glassy structure, and availability, waste glass was determined to be a feasible option for addition. The specimens with glass additions exhibited an increase in compressive and flexural strength, a decrease in the initial rate of absorption, and an increase in firing shrinkage. The determination of feasibility of adding slag or biological waste to bricks was hindered by a lack of comparable data; however, the limited comparison available suggested the necessity for additional, directly comparable testing programs. As a result, an experimental program was developed to investigate potential benefits in terms of strength, absorption, and durability of bricks associated with the addition of waste glass, as well as economic and environmental gains as a result of the process.

3. **A. Venkatesan et al., 2015 Based** on experimental investigations concerning compressive strength and water absorption of the Brick, the following results were obtained, Compressive strength decreases on increase in percentage of wood ash as compare to charcoal brick. The different percentage of wood ash and charcoal (5%, 10% & 15%) are added with cement and sand. The compressive strength for both bricks are decreased. In that charcoal brick has maximum compressive strength ie.,(11.07 N/mm2 for 15 % of charcoal) than wood ash brick (7.9 N/mm2 for 15% of wood ash).The water absorption for both the bricks are increases with percentage of (5%,10%,15%).In that the charcoal brick has less amount of water absorption ie.,(4.45% for 15% of charcoal) than wood ash brick(15.80% for 15% of wood ash).Thus from above study, this project concluded that, with the addition of charcoal in the cement and sand, the compressive strength of bricks increases and water absorption decreases than wood ash bricks.

4. **Rania Hamza, Salah El-Haggar, Safwan Khedr et al., 2011** Marble and granite slurry cement bricks yield similar mechanical, in terms of compressive strength, and physical, in terms of density and absorption, properties. There is a positive effect of granite slurry on cement brick samples that reach its optimum at 10% slurry incorporation. Absorption is the major drawback of slurry incorporation in cement bricks according to the ASTM C55 where water absorption requirement is full filled only at Zero, 10 %, and 20% slurry samples for grade S. The accelerated hydration, endued by heating, compensated the detrimental effect of volumetric changes associated with temperature variation. Most cement brick samples, including the control, are of normal weight according to both the Egyptian specifications and ASTM C55.All cement brick samples tested in this study comply with the Egyptian code requirement for structural bricks. This is not true when compared to ASTM C55. Instead, 10% and 20%

5. **Virendra Kumara at al., 2015** Granite sludge powder generates in processing activities of granite stone, such as cutting, polishing and finishing process. This contributes of about 30% wastage in these processes. As granite sludge powder is non- biodegradable waste, it has to be effectively disposed without creating environmental hazards. In our present study the objectives are to prepare Granite Sludge blocks of size230×110×70(mm) for varying mix proportions such as 20%, 30%, 40%, 50%,60%, and 70% for granite sludge powder and sand, by keeping lime 8% and gypsum 2% as constant. To find Mechanical properties such as Compressive Strength, Flexural strength and Water absorption, where maximum compressive Strength value for 7 days of 5.54 MPa, maximum flexural strength of 2.17 MPa And maximum breaking load 4.33kN was obtained for A3 block type. Water Absorption of granite sludge blocks increases with increase in addition of granite Sludge powder in mix proportions, yet it is in limit as per IS code specifications. Utilizing granite sludge powder for manufacturing of granite sludge masonry Blocks is one of efficient manner to minimize the disposal problems of granite

Sludge powder.

6. **R.Nithiya ct al., 2016** Majority of the people prefer burnt bricks for the construction purpose which emits nearly about 1 ton of CO2.The usage of environmental friendly, structurally sound and in expensive materials was used in the ancient centuries. The stabilized bricks are the one which have a low embodied energy of 0.42 MJ/kg and low carbon foot print. This paper presents the strength of the bricks by using. Thus from above study, this project concluded that, with the addition of charcoal in the cement and sand, the compressive strength of bricks increases and water absorption decreases than wood ash bricks. Utilizing granite sludge powder for manufacturing of granite sludge masonry Blocks is one of efficient manner to minimize the disposal problems of granite Sludge powder.

III.METHODOLOGY

Data was collected from the study area, review of literature and secondary source of information. The main aim is to identify materials and check the parameter of materials using study. Material parameters are mainly used for design the mix as per code practices. Mix design can be calculated from the procedure for prepare the specimen. Brick will be Casted and burned. Finally specimen will be tested to get results.

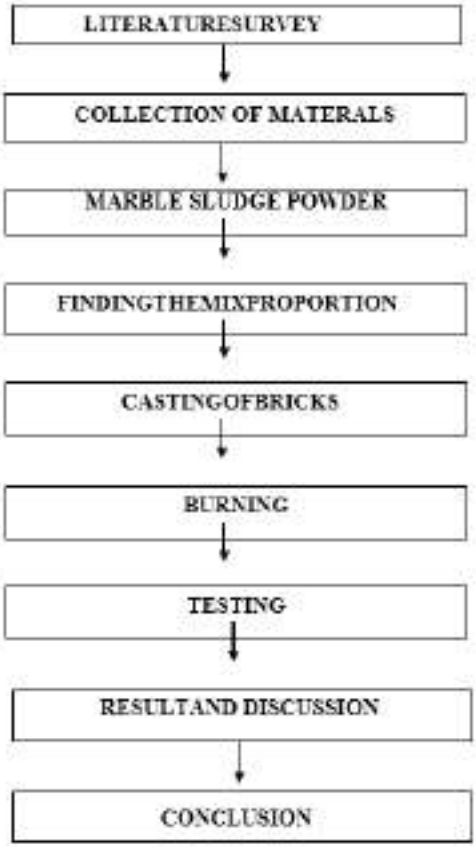

Fig 1 Methodology

IV.TESTING PROGRAM

1. MATERIALS

i) Marble sludge powder:

Marble is a metamorphic rock resulting from the transformation of pure lime stone. Marble sludge powder is an industrial waste containing heavy metals as constitutes. Chemically, marbles are crystalline rocks composed predominantly of calcite, dolomite or serpentine materials. The other mineral constituents vary from origin to origin.

ii) RED SOIL:

Red soil is a type of soil that develops in a warm, temperate, moist climate under deciduous or mixed forests and that have thin organic and organic-mineral layers overlying a yellowish-brown leached layer resting on an alluvial (see illuviation) red layer. Red soils generally derived from crystalline rock

iii) CLAY:

Clay is a fine-grained natural rock or **soil** material that combines one or more **clay** minerals with traces of metal oxides and organic matter. Geologic **clay** deposits are mostly composed of phyllosilicate minerals containing variable amounts of water trapped in the mineral structure.

iv) WATER:

Ordinary potable water

2. MIX DESIGN

Mix design for control specimen of bricks
(As per code IS3495-P(1)-1992) Methods of tests of burnt clay building bricks compressive strength of Clay brick can be determined.

.

Adjustment is made according to IS code.

Sample	Sand (Kg)	Clay (Kg)	Marble sludge powder (Kg)	Water in % in weight
CS	2.7	0.3	-	10
S1	2.56	0.3	0.135	10
S2	2.43	0.3	0.27	10
S3	2.3	0.3	0.405	10
S4	2.16	0.3	0.54	10

Table 2: Mix design

3. MIX PROPTION

SAMPLE	MARBLE SLUDGE (%in vol.)
CS	0
S1	5
S2	10
S3	15
S4	20

Table 3: Mix Proportion

In order to know the best proportion of Marble sludge powder. To make 100 different test bricks of dimension 19x9x9cm. The different four proportions are as following

V.RESULTS AND DISCUSSIONS

1. COMPRESSIVE STRENGTH

Table 1: Compressive strength Test

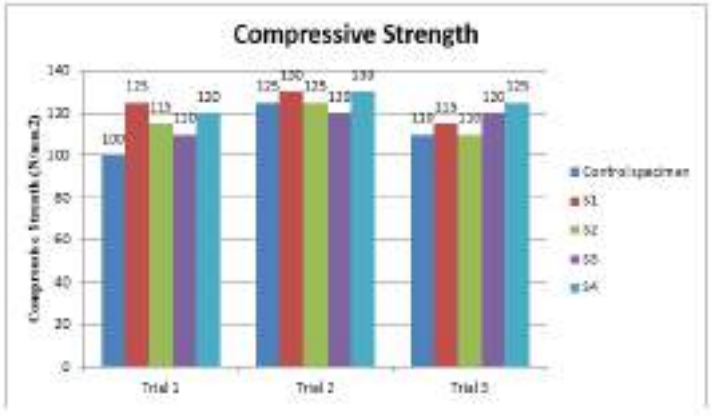

Fig: 1 COMPRESSIVE STRENGTH TEST

2. THERMAL CONDUCTIVITY TEST

Thermal conduction is the transfer of heat from one part of a body to another with which it is in contact. Thermal conductivity is defined as ability of material to transmit heat and it is measured in watts per square meter of surface area for a temperature gradient of 1 K per unit thickness of 1 m. The thermal conductivity is not always constant. The main factors affected the thermal conductivity are the density of material, moisture of material and ambient temperature. With increasing density, moisture and temperature the thermal conductivity increases to. Important is inner structure of materials. Metals and other dense solid materials tend to have high levels of increases to. Important is inner structure of materials. Metals and other dense solid materials tend to have high levels of conductivity, whereas materials with very small amount of solid matter and large proportion of voids (gas or air bubbles, not large enough to carry heat by convection) have the lowest thermal conductivities

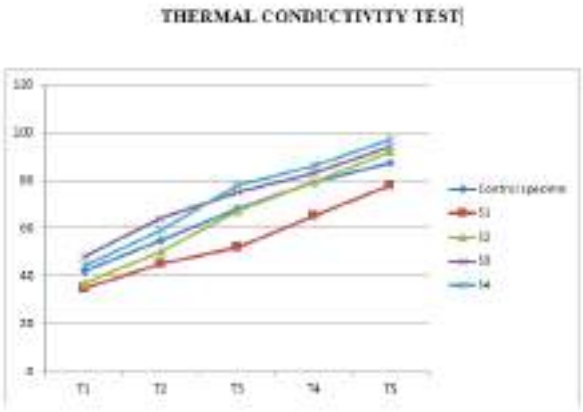

Fig: 2 THERMAL CONDUCTIVITY TEST

VI.CONCLUSION

The following conclusions could be drawn from the present investigation.

- Marble sludge powder waste content up to 5%, 10%, 15%&20% by vol can be replaced in Sand mixture, without degrading their mechanical properties.
- The presence of marble sludge powder allow one to obtain a clay brick with better properties as the conventional clay brick at low temperatures as
- The normally used for brick products in the brick industry, resulting in energy saving and waste reduction.
- The incorporation of marble sludge powder in brick production anticipates safe for the health an environmentally friendly recycling products.
- Therefore, utilization of solid wastes has been encouraged as one of the most cost-effective alternative materials.
- That could be used in fired clay brick manufacturing.
- Recycling industrial and urban waste in fired clay brick is useful if the correct percentages were incorporated.
- Brick manufacturer will reduce the cost of raw materials, the usage of energy during firing and the improvement of the properties.

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ACID RESISTANCE OF BRICK

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Abstract
Brick is one of the most common masonry units as a building material due to its properties. The rapid growth in today's construction industry has obliged the civil engineers in searching for more efficient and durable alternatives far beyond the limitations of the conventional brick production. Many attempts have been made to incorporate wastes into the production of bricks and recycling such wastes by incorporating them into building materials is a practical solution for pollution problem. So the proposed system is to the invention of waste marble sludge powder and bottom ash as the replacement of clay bricks regarding the strength and durability studies. In our project, totally 100 number of bricks are to be casted with partial replacement of marble sludge powder. The percentage of replacement is carried out in this work as 0%, 5%, 10%, 15% and 20% by total volume. The strength and durability test of bricks is to be calculated.

Keywords: Thermal resistant, Marble Sludge powder, compressive strength, Minimum percentage

I. INTRODUCTION

Brick is one of the oldest manufactured building materials in the world. As early as 14,000 BC, hand-moulded and sun-dried clay bricks were found in the lower layers of Nile deposits in the Egypt. Clay was also ancient Mesopotamia's most important raw material and most buildings during that time were made of clay bricks. The earliest use of bricks recorded was the ancient city of Ur (modern Iraq) that was built with mud bricks around 4,000 BC and the early walls of Jericho around 8,000 BC. Starting from 5,000 BC, the knowledge of preserving clay bricks by firing has been documented. The fired bricks were further developed as archaeological traces discovered in early civilizations, such as the Euphrates, the Tigris and the Indus that used both fired and unfired bricks. The Romans used the fired bricks and were responsible for their introduction and use in England. However, the brick making craft declined following the departure of the Romans from Britain in 412 AD and was only revived later by Flemish brick makers. The development of different types of bricks continued in most countries in the world and bricks were part of the cargo of the First Fleet to Australia, along with brick moulds and a skilled brick maker. Bricks have continuously been used by most cultures throughout the ages for buildings due to their outstanding physical and engineering properties. Brick is one of the most demanding masonry units. It has the widest range of products, with its unlimited assortment of patterns, textures and colours.IN1996, the industry produced 300 million bricks in Victoria, which were about 55% of the potential production of the facilities available. The export markets included Japan, New Zealand, the Middle East and other Asian countries. This is equivalent to an annual turnover of 130 million dollars. Brick is durable and has developed with time. It remains highly competitive, technically and economically, with other systems of structure and field. The main raw material for bricks is clay besides clayey soils, soft slate and shale, which are usually obtained from open pits with the attendance of disruption of drainage, vegetation and wildlife habitat. Clays used for brick making vary broadly in their composition and are dependent on the locality from which the soil originates. Different proportions of clays are composed mainly of silica, alumina, lime, iron, manganese, sulphur and phosphates.

II.LITERATURE VIEW

1. Dr.C.Anbalagan et al., 2016 Majority of the people prefer burnt bricks for the construction purpose which emits nearly about 1 ton of CO2. The usage of environmental friendly, structurally sound and in expensive materials was used in the ancient centuries. The stabilized bricks are the one which have a low embodied energy of 0.42 MJ/kg and low carbon foot print. This paper presents the strength of the bricks by using different recyclable materials like coconut fiber, granite waste and egg shell powder.

2. L.M. Federico, S.E. Chidiac, R.G. Drysdale et al., 2005 Fired clay bricks are produced when clay particles bond to one another at high temperatures,

Forming a glassy material, which, upon cooling, displays high strength and durability properties. High temperatures required to melt SiO2 mean high energy cost associated with brick

In addition to cost, challenges facing the modern brick industry include shortages of raw material and environmental impacts of production. The feasibility of using waste material as a brick body was investigated, where several possible waste additives, including slag, biological waste, and waste container glass, were considered. A literature review was conducted in order to assimilate past work and experimental results. The results of several testing programs were compared and the feasibility of further work in the addition of waste additives to bricks was
Its soda content, amorphous glassy structure, and availability, waste glass was determined to be a feasible option for addition. The specimens with glass additions exhibited an increase in compressive and flexural strength, a decrease in the initial rate of absorption, and an increase in firing shrinkage. The determination of feasibility of adding slag or biological waste to bricks was hindered by a lack of comparable data; however, the limited comparison available suggested the necessity for additional, directly comparable testing programs. As a result, an experimental program was developed to investigate potential benefits in terms of strength, absorption, and durability of bricks associated with the addition of waste glass, as well as economic and environmental gains as a result of the process.

3. **A. Venkatesan et al., 2015 Based** on experimental investigations concerning compressive strength and water absorption of the Brick, the following results were obtained, Compressive strength decreases on increase in percentage of wood ash as compare to charcoal brick. The different percentage of wood ash and charcoal (5%, 10% & 15%) are added with cement and sand. The compressive strength for both bricks are decreased. In that charcoal brick has maximum compressive strength ie.,(11.07 N/mm2 for 15 % of charcoal) than wood ash brick (7.9 N/mm2 for 15% of wood ash).The water absorption for both the bricks are increases with percentage of (5%,10%,15%).In that the
charcoal brick has less amount of water absorption ie.,(4.45% for 15% of charcoal) than wood ash brick(15.80% for 15% of wood ash).Thus from above study, this project concluded that, with the addition of charcoal in the cement and sand, the compressive strength of bricks increases and water absorption decreases than wood ash bricks.

4. **Rania Hamza, Salah El-Haggar, Safwan Khedr et al., 2011** Marble and granite slurry cement bricks yield similar mechanical, in terms of compressive strength, and physical, in terms of density and absorption, properties. There is a positive effect of granite slurry on cement brick samples that reach its optimum at 10% slurry incorporation. Absorption is the major drawback of slurry incorporation in cement bricks according to the ASTM C55 where water absorption requirement is full filled only at Zero, 10 %, and 20% slurry samples for grade S. The accelerated hydration, endued by heating, compensated the detrimental effect of volumetric changes associated with temperature variation. Most cement brick samples, including the control, are of normal weight according to both the Egyptian specifications and ASTM C55.All cement brick samples tested in this study comply with the Egyptian code requirement for structural bricks. This is not true when compared to ASTM C55. Instead, 10% and 20%

5. **Virendra Kumara at al., 2015** Granite sludge powder generates in processing activities of granite stone, such as cutting, polishing and finishing process. This contributes of about 30% wastage in these processes. As granite sludge powder is non- biodegradable waste, it has to be effectively disposed without creating environmental hazards. In our present study the objectives are to prepare Granite Sludge blocks of size230×110×70(mm) for varying mix proportions such as 20%, 30%, 40%, 50%,60%, and 70% for granite sludge powder and sand, by keeping lime 8% and gypsum 2% as constant. To find Mechanical properties such as Compressive Strength, Flexural strength and Water absorption, where maximum compressive Strength value for 7 days of 5.54 MPa, maximum flexural strength of 2.17 MPa And maximum breaking load 4.33kN was obtained for A3 block type. Water Absorption of granite sludge blocks increases with increase in addition of granite Sludge powder in mix proportions, yet it is in limit as per IS code specifications. Utilizing granite sludge powder for manufacturing of granite sludge masonry Blocks is one of efficient manner to minimize the disposal problems of granite
Sludge powder.

6. **R.Nithiya ct al., 2016** Majority of the people prefer burnt bricks for the construction purpose which emits nearly about 1 ton of CO2.The usage of environmental friendly, structurally sound and in expensive materials was used in the ancient centuries. The stabilized bricks are the one which have a low embodied energy of 0.42 MJ/kg and low carbon foot print. This paper presents the strength of the bricks by using. Thus from above study, this project concluded that, with the addition of charcoal in the cement and sand, the compressive strength of bricks increases and water absorption decreases than wood ash bricks. Utilizing granite sludge powder for manufacturing of granite sludge masonry Blocks is one of efficient manner to minimize the disposal problems of granite Sludge powder.

III.METHODOLOGY

Data was collected from the study area, review of literature and secondary source of information. The main aim is to identify materials and check the parameter of materials using study. Material parameters are mainly used for design the mix as per code practices. Mix design can be calculated from the procedure for prepare the specimen. Brick will be
Casted and burned. Finally specimen will be tested to get results.

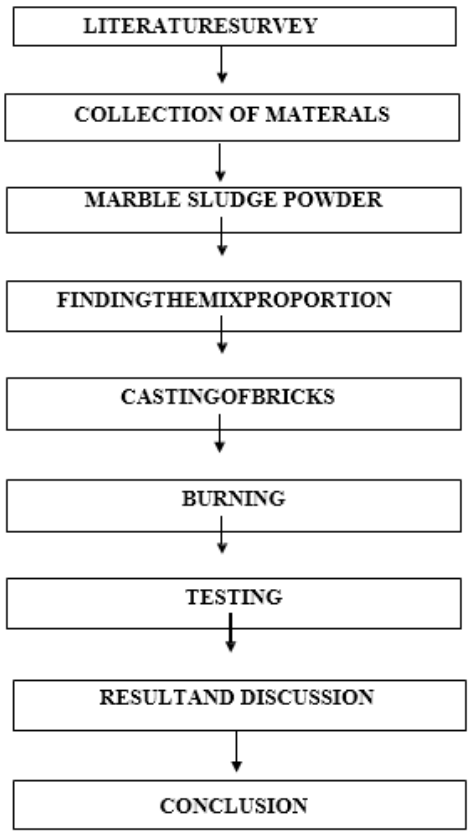

Fig 1 Methodology

IV.TESTING PROGRAM

1. MATERIALS

i) Marble sludge powder:

Marble is a metamorphic rock resulting from the transformation of pure lime stone. Marble sludge powder is an industrial waste containing heavy metals as constitutes. Chemically, marbles are crystalline rocks composed predominantly of calcite, dolomite or serpentine materials. The other mineral constituents vary from origin to origin.

ii) RED SOIL:

Red soil is a type of soil that develops in a warm, temperate, moist climate under deciduous or mixed forests and that have thin organic and organic-mineral layers overlying a yellowish-brown leached layer resting on an alluvial (see illuviation) red layer. Red soils generally derived from crystalline rock

iii) CLAY:

Clay is a fine-grained natural rock or **soil** material that combines one or more **clay** minerals with traces of metal oxides and organic matter. Geologic **clay** deposits are mostly composed of phyllosilicate minerals containing variable amounts of water trapped in the mineral structure.

iv) WATER:

Ordinary potable water

2. MIX DESIGN

Mix design for control specimen of bricks
(As per code IS3495-P(1)-1992) Methods of tests of burnt clay building bricks compressive strength of Clay brick can be determined.

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Adjustment is made according to IS code.

Sample	Sand (Kg)	Clay (Kg)	Marble sludge powder (Kg)	Water in % in weight
CS	2.7	0.3	-	10
S1	2.56	0.3	0.135	10
S2	2.43	0.3	0.27	10
S3	2.3	0.3	0.405	10
S4	2.16	0.3	0.54	10

Table 2: Mix design

3. MIX PROPTION

SAMPLE	MARBLE SLUDGE (%in vol.)
CS	0
S1	5
S2	10
S3	15
S4	20

Table 3: Mix Proportion

In order to know the best proportion of Marble sludge powder. To make 100 different test bricks of dimension 19x9x9cm. The different four proportions are as following

V.RESULTS AND DISCUSSIONS

1. Water Absorption Test

S. NO	sample	time (hrs)	Dry weight (kg) Trial 1	Trail 2	Wet weight (kg) Trial 1	Trial 2	LOSS IN WEIGHT IN (%)
1	CS	24	3.20	3.04	2.98	2.86	6.41
2	S1	24	2.88	2.85	2.67	2.63	7.6
3	S2	24	2.76	2.76	2.61	2.58	5.8
4	S3	24	2.95	2.86	2.70	2.67	6.4
5	S4	24	2.84	2.83	2.64	2.57	8.3

Table 1: Water Absorption Test

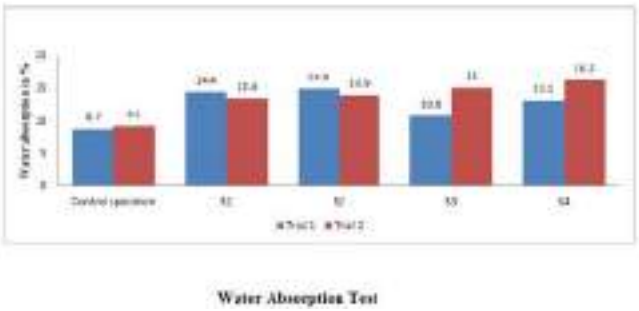

Fig: 1 Water Absorption Test

2. Acid Resistance Test

S. NO	sample	time (hrs)	Dry weight (kg) Trial 1	Trail 2	Wet weight (kg) Trial 1	Trial 2	LOSS IN WEIGHT IN (%)
1	CS	24	3.20	3.04	2.98	2.86	6.41
2	S1	24	2.88	2.85	2.67	2.63	7.6
3	S2	24	2.76	2.76	2.61	2.58	5.8
4	S3	24	2.95	2.86	2.70	2.67	6.4
5	S4	24	2.84	2.83	2.64	2.57	8.3

Table 2: Acid Resistance Test

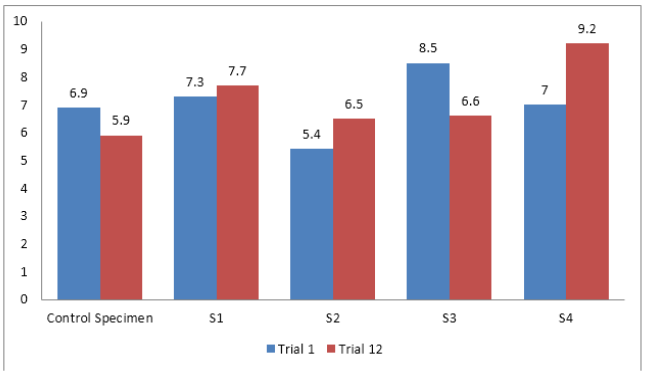

Fig: 2 Acid Resistance Test

VI.CONCLUSION

The following conclusions could be drawn from the present investigation.

- Marble sludge powder waste content up to 5%, 10%, 15%&20% by vol can be replaced in Sand mixture, without degrading their mechanical properties.
- The presence of marble sludge powder allow one to obtain a clay brick with better properties as the conventional clay brick at low temperatures as
- The normally used for brick products in the brick industry, resulting in energy saving and waste reduction.
- The incorporation of marble sludge powder in brick production anticipates safe for the health an environmentally friendly recycling products.
- Therefore, utilization of solid wastes has been encouraged as one of the most cost-effective alternative materials.
- That could be used in fired clay brick manufacturing.
- Recycling industrial and urban waste in fired clay brick is useful if the correct percentages were incorporated.
- Brick manufacturer will reduce the cost of raw materials, the usage of energy during firing and the improvement of the properties.

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Assessment of construction delay in multistory building projects Assist of RII Method

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Abstract—*Delays are one of the biggest problems in construction projects in developing countries, as cause a negative effects on the projects. Delays can be minimized only when their causes are identified. The aim of this paper is to identify the main causes of delay in construction projects. The literature related the field of causes of delay in construction projects has been reviewed over the last decade. A questionnaire survey was conducted to solicit the causes of delay from consultants, clients and contractors' viewpoint. This study identified 10 most important causes of delay from a list of 45 different causes of delay. The elements of this list has identified on the basis of literature review over the last decade. The perspective of contractors and consultants has been analyzed to rank the causes of delays based on their Relative Importance Index. The 10 most causes of delay were:*

(1) Shortage of construction materials in market, (2) Escalation of material prices, (3) Delay in material delivery, (4) Demonetization issue of financial problem, (5) Shortage of labors, (6) Delay in payment of completed work by owner, (7) Changes in quality of material, (8) Poor labor supply & labor productivity, (9) Banking restriction, and (10) Unqualified workforce.

Keywords—causes of delay, Relative Importance Index, Construction projects.

I. INTRODUCTION

Delays are one of the biggest problems which construction firms face. The problem of delay in the construction industry is a global phenomenon. Therefore construction delays can be considered as time lag in completion of activities from a fixed time as per contract or they can be defined as late completion or late start of activities to the planned schedule or contract schedule. When project delay occurs it means project cannot be completed within stated time, which means there will be extensions of time required which will further result in fine, increased cost due to inflation, termination of contract, court cases etc. or combinations of above stated factors. Delay can be seen as risk for the project and could be handled at inception stage or at least one can try to mitigate or minimize it. Risk is an integral part of a construction project; it is well known that no project is risk free. If risk is analyzed at inception or planning stage it could be managed, minimized, shared, mitigated or accepted to give some good results. Delay can be considered similar to risk or a type of risk; as no construction project is free from delays, delay is also integrated part of construction projects. It depends on size of project as well. Therefore it is expected to analyse and manage delay in same fashion as risk.

1.1 TYPES OF DELAYS

The following are the types of delays in construction projects;

1). Critical or Non critical delays

2). Excusable or Non Excusable delays

3). Compensable or Non Compensable delays

4). Concurrent or Non concurrent delays

1.1.1 Critical or Non critical

In simple words Critical delays are those which cause delay to entire project completion date while Non critical delays not necessarily affect the project completion date but affects progress. In all the projects delays are considered at the project completion date. Delays can be combination of small and big delays that occurred during the whole project. Therefore critical delays are taken more into consideration then noncritical delays

1.1.2 Excusable or Non Excusable delays

Excusable delays occurs due to events which are outside the control of contractor like heavy rains, storms, strikes, fire, client suggested changes, differing site conditions, change of government policy or their intervention, stakeholder intervention etc., As name suggests these delays are such that they don't have any excuse or no excuse can be given for them. They arise due to carelessness or actions and inactions of contractors and subcontractors. For such delays no time extensions and monetary

compensation is given to contractor if it has affected whole duration of project.

1.1.3 Compensable or Non Compensable delays

As name suggests excusable compensable delays are those in which contractor is entitled for extra payment (compensation) i.e. monetary compensation and time extension as well. But decision that a delay is compensable or non compensable is taken as per contract between client and contractor. Natural disasters or some reasons which are out of control are not considered.

1.1.4 Concurrent or Non concurrent delays

Concurrent delays which contains two or more excusable delays results in time extension. When compensable and non excusable delays are concurrent a time extension can be given or delay can be distributed between client and contractor.

1.2 AIM

The aim of this project is to identify the causes of delay in multistory building construction and how to be avoided and control based on the identified factors causing delay of construction process.

1.3 OBJECTIVES

- To find out the factors that causes construction projects delay.
- To investigate the effects of construction projects delay.
- To determine the risks associated with construction projects delay.
- To identify the relevant ways of eliminating or mitigating the delays of construction.

II. LITERATURE REVIEW

1. Towhid Pourrostam and Amiruddin Ismail (2012) "Causes and Effects of Delay in Iranian Construction Projects"

The aim of this paper is to identify 28 main causes and 6 effects of delay in Iranian construction projects. A questionnaire survey was conducted to solicit the causes of delay from consultants and contractors viewpoint. The perspective of contractors and consultants has been analyzed to rank the causes of delays based on their Relative Importance Index. Clients should make progress in payments to contractors on time, recruit competent project manager, and on time preparation and procurement of needed materials to the contractors.

2.Kasimu Alhaji Mohammed and Abubakar Danladi Isah(2012)"Causes of Delay in Nigeria Construction Industry"

The aim of this paper is to investigate the causes of delay in Nigeria construction industry. The data collected was analyzes in rating form to determine the most causes of delay in the construction projects. 150 questionnaires were distributed and only 127 questionnaires were filled correctly. Based on the mean value criterion, the first ranking seemed that improper planning, Lack of effective communication as the second ranked factor and Shortage of supply i.e. steel, concrete, etc. and Design Errors.

3.M.Haseeb,Xinhai-Lu, Aneesa Bibi, Maloof-ud-Dyian and Wahab Rabbani (2011)"Problems of Projects and Effects of Delays in the Construction Industry of Pakistan"

This paper covers the delay factors and causes of delay and some suggestion for reducing these delays in large construction projects in Pakistan. There were two part of the questionnaire, Part A, Part B. Part A asked about the respondent's personal information, where he is client, consultant, contractor, subcontractor etc. Part B asked about the information related to causes and factors of delay in large construction projects of pakistan. Most factors related to consultant it is due to not understanding the client necessities, not having proper project information, absence of some detail in drawing etc.

4. Murali Sambasivan ,Yau Wen Soon (2007) "Causes and effects of delays in Malaysian construction industry"

This study has also establishment an empirical relationship between each cause and effects. In this research we identify major causes of delay and categorized them as client-related, contractor –related, consultant –related, material-related, labor-related contract- related and external factors. Relatively importance index method. We also studied the empirical relationship between the causes and effects of delays. We isolated the causes of delay for each of effects .

5.Nitish Kumar and Peer Hilal Ahmad (2016) "A Study on Delay of Construction projects in India" The development of country the construction the construction industry is the main ingredients for an economy. In India, most of the projects are executed through contracts which are generally not easy to comprehend. The primary objective during the construction process is to complete the project within budget, while meeting established quality requirements and other specification. Adopt new approaches to contracting, such as construction management & design-build type of contracts.

6.Musirikare Mihigo Amandin and Julius Warren Kule (2016)"Project Delay on Cost Overrun Risks: A Study of Gasabo District Construction Projects Kigali, Rwanda"

The major causes of project delays and costs/risks that arise from project delays when implementing public construction projects. The study adopted a descriptive survey research design. Data were collected using open-ended questionnaire. This involved collecting data from construction project

contractors, consultants or officers during the period starting from 2009 till 2012in Gasabo,a district in Kigali, Rwanda. In addition, when construction projects' expected or planned cost is increased, a simultaneous increase in their relative real cost must take place.

7.Mohamed M. Marzouk and Tarek I. EI-Rasas (2014)"Analyzing delay causes in Egyptian construction projects"

This research presents a list of construction delay causes from literature. The feedback of construction experts was obtained through interviews. Statistical analysis is carried out using analysis of variance ANOVA method to test delay causes, obtained from the survey. The feedback of construction experts was obtained through interviews and surveys. Frequency Index, Severity Index, and Importance Index are calculated and according to the highest values of them the top ten delay causes analysis of construction projects in Egypt are determined.

8. Alena Vasilyeva-Lyulina, Masamitsu Onishi and Kiyoshi Kobayashi (2015)"Delay Analysis Methods For Construction Projects: Mathematical Modelling"

This paper aim to formalising delay analysis methods commonly applied in practice employing the mathematical language**.** The damages caused by a projects delay in compensated by the contractor in principles in the form of liquidated damage. Delay takes only three forms ;1.delay to commencement ,2.extended duration,3.suspension during performance**.** Formalization of the delay analysis method. This study proposed a formal description of delay analysis methods that would be applicable to any types of them so that delay analysts can avoided any confusion caused by name approach.

9.Asish Ram and Dr. Pratheeba Paul (2015) "Study on Construction Sequence Delay for Road Infrastructure Projects"

Delays can lead to many negative effects such as lawsuits between owners and contractors, increased costs, loss of productivity and revenue, and contract termination. The gathered data are analyzed through Relative Importance Index (RII) and the delay causes are ranked as per their significance. Most of the government initiated infrastructure projects are delay and get finished years after there scheduled completion. The delay in land acquisition is an owner or client related delay factor that is an excusable type of delay.

10.Megha Desai and Rajiv Bhatt (2013)"Critical Causes of Delay in Residential Construction Projects: Case Study of Central Gujarat Region of India"

This paper suggests an approach to carry out ranking of causes of delay by two different techniques: Relative importance index and Importance index based on degree of severity and degree of frequency and also discuss about the ranking of the causes. Delay on construction projects are a universal phenomenon. They are almost always accompanied by cost and time overrun. The delay in construction projects in India is studied through field survey. It studied frequency, severity and importance and relative importance of the causes of delay.

III. RESEARCH METHODOLOGY

This chapter comprises of the method and the design that was used to conduct the research. It's a quantitative research in which the data was collected using questionnaires. The population was made of clients, contractors and consultants who were selected by random sampling and convenience sampling technique. There was collection of both primary and secondary data. The primary data was obtained using questionnaires while the secondary data was gathered from the literature. In addition this chapter also presents the questionnaire design, the different sections of the questionnaires, the scale as well as the pilot study that was conducted to ascertain the reliability of the questionnaire. Research methodology chosen for this study comprised of intensive literature review, mail questionnaire to building construction stake holders in Sudan and a statistical analysis of the Survey.

Fig1. METHODOLOGY CHART

3.1 RESEARCH DESIGN

The research was designed to get opinions from clients, consultants and contractors other construction related companies in regards to the factors causing delays, effects of delays, as well risks associated with construction delays. The possible causes, effects and risks of delays were identified from the literature and these factors were tested with the stakeholders of the Sudanese construction industry. A total of 45 delay factors were identified

from the literature and stake holders of the indian construction industry were asked to give their opinion on these causes in the form of ranking. Also effects of construction projects delay were also identified from the literature and questions were designed according to these factors to get the opinion from stake holders of Sudanese construction industry. Similarly, risks factors associated with construction projects delays were also identified.

3.2 POPULATION AND POPULATION SIZE

The population was made of consultants, contractors with over 10years of experience in the construction industry and private clients or owners. Moreover all respondents had attained tertiary education. This implied the high position, lengthy years of work experience and educational background provided our respondents with enough knowledge of the construction industry with issues relating to causes, effects and risks of construction delay. The population size consisted of 100 respondents, which included 26 contractors, 24 consultants,18 owner, 09 clients, 23 others. The population size was limited to this number to effectively maximize the time and cost allocated for the research since the questionnaires had many questions and will be time consuming which might discourage some respondents from participating. Also the wide nature of the questionnaire may not be within the competence of some construction stakeholders. However effective selection of the target respondents with high competence and experience proved to shield these weaknesses.

3.3 DATA COLLECTION

This is referred to as the gathering or the collection of information from customized target respondents to suitably answer the research questions or the research objectives or give answers to findings. In this study, the data was obtained using 2 different methods.

3.3.1 Primary data collection

The primary data refers the first hand information obtained by the researcher himself in his or her study. This information is made available for the first time only by the researcher. The information can be collected through direct personal investigations, through respondents, and survey using questionnaires. The collection modes could also be through; emails, personal interview, phone interview and self-administered survey. The advantages of this method of data collection include; reliability and accuracy and moreover it is a better method for intensive investigation. On the other hand, the disadvantages will be high cost and too much time spent, and the method is not suitable for extensive enquiry. Because of the quantitative nature of our study, the primary data was collected in the survey by making use of questionnaires and also telephone interviews. The questionnaires were emailed to our target respondents who were expected to fill the soft copy of the questionnaires and returned them by emails.

3.3.2 Secondary data collection

The secondary data refers to that information which have already been collected, analyzed, documented and published by some other researchers or people. The researcher therefore uses this information to support his or her current study or findings. Obtaining this information is faster, less expensive, and vigorous activities such as surveys are not required. However, this information collected is not always available for free and will cost money, the information are not always enough, some are old or expired meanwhile some are false information. In this study, our secondary data was collected from academic online websites such as Emerald, online journals, School libraries and both published and unpublished articles.

3.4 QUESTIONNAIRES

In order to determine the perception of different stake holders in Sudan construction industry regarding factors causing delays, a questionnaire was developed. This was the main tool used to collect the data from our target respondents. The questionnaire was structured into 8 sections to meet all 4 research objectives.

For questions relating to mitigating risks due to construction delays, a total measures were identified from the literature and the questionnaires were design using the 5 point Likert scale to determine the effectiveness of each of these measures.

Table 1. Five Point Likert Scale

Extremely Significant	(5)
Very Significant	(4)
Moderately Significant	(3)
Slightly Significant	(2)
Not Significant	(1)

IV. DATA ANALYSIS AND RESULT

This chapter presents a series of statistical tests and analysis carried out for the factors of each of the sections. These include the causes of delay, effects of delay, the risks of delay as well as ways of mitigating delays. It also presents the results of the questionnaires which were carried out using Relative Important Index (RII).

To determine the relative ranking of the factors, mean values were then transformed to importance indices based on the formula:

RII = $\frac{\sum w}{AN} = \frac{5n_5 + 4n_4 + 3n_3 + 2n_2 + 1n_1}{5N}$

where, *w* is the weight given to each factor by the respondent, ranging from 1 to 5,
(*n1* = number of respondents for very unsatisfied ... *n5* = number of respondents for very satisfied)
A is the highest weight (i.e. 5 in the study) and *N* is the total number of samples.
The relative importance index ranks from 1 to 45. Weighted Mean, RII, and the ranking of the most important factors are presented later in Table 2.

Table 2: Summary of Relative Importance Index and Rank for the causes of delay in construction projects

Sl.No.	Factors that the delay in construction	RII	Rank
1.	Poor communication & co-ordination by owner and other parties	0.460	34
2.	Misunderstandings in technical dealing with tenders & contractors	0.488	19
3.	Conflict in joint ownership	0.446	38
4.	Delay in payment of completed work by owner	0.560	6
5.	Late revising and approving relevant documents by owner	0.508	12
6.	Less authority given to consultant to take decision	0.462	32
7.	Unclear and inadequate details in drawings	0.464	31
8.	Communication barriers faced by consultant	0.416	44
9.	Total quality management by consultant	0.442	39
10.	Inadequate site information given to consultant	0.476	24
11.	Ineffective planning and scheduling of project	0.508	12
12	Delay in preparation of shop drawing and material sample	0.488	19
13.	Delay in site mobilization	0.502	15
14.	Compatibility of contractor with new software's	0.450	37
15.	Risk analysis & management by contractor	0.474	26
16.	Source updating in the design engineering documents & related	0.462	32
17.	Shortage of construction materials in market	0.578	2
18.	Delay in material delivery	0.574	3
19.	Changes in quality of material	0.544	7
20.	Escalation of material prices	0.584	1
21.	Material damage in storage	0.486	22
22.	Slow process of material selection	0.508	12
23.	Shortage of labors	0.564	5
24.	Unqualified workforce	0.514	11
25.	Equipment availability and failure	0.496	17
26.	Shortage of recent technology equipment	0.474	26
27.	Delay in equipment delivery	0.518	10
28.	Poor labor supply & labor productivity	0.532	8
29.	Traffic control at site	0.376	45
30.	Insufficient data collection and survey	0.440	41
31.	Accidents on site	0.454	35
32.	Rework due to error in construction	0.502	15
33.	Problem due to existing structures	0.480	23
34.	Unforeseen ground conditions	0.466	29
35.	Bad weather condition and poor lighting	0.442	39
36.	Environmental changes due to rainy and hot season	0.452	36
37.	Natural disasters (Earthquake, floods etc.,)	0.476	24
38.	Inclement weather effects	0.424	43
39.	Effects of subsurface conditions(soil, high water table etc.,)	0.466	29
40.	Changes in government regulation & laws	0.496	17
41.	Restriction due to site location	0.488	19
42.	Regulatory changes in building code	0.472	28
43.	Various issues in respective states	0.436	42
44.	Demonetization issue of financial problem	0.572	4
45.	Banking restriction	0.524	9

Table 3: Ten most important causes of delay in construction projects

Sl.No.	Factors that the delay in construction	RII	Rank
1.	Escalation of material prices	0.584	1
2.	Shortage of construction materials in market	0.578	2
3.	Delay in material delivery	0.574	3
4.	Demonetization issue of financial problem	0.572	4
5.	Shortage of labors	0.564	5
7.	Changes in quality of material	0.544	7
8.	Poor labor supply & labor productivity	0.532	8
9.	Banking restriction	0.524	9
10.	Delay in equipment delivery	0.518	10

V.RECOMMENDATION AND CONCLUSION

This study identified the causes of delay in construction projects. Projects investigated in this study included residential, office and administration buildings. A questionnaire survey was conducted to solicit the causes and effect of delay from consultants and contractors' viewpoint. Ten most causes of delay were: (1) Shortage of construction materials in market, (2) Escalation of material prices, (3) Delay in material delivery, (4) Demonetization issue of financial problem, (5) Shortage of labors, (6) Delay in payment of completed work by owner, (7) Changes in quality of material, (8) Poor labor supply & labor productivity, (9) Banking restriction, and (10) Unqualified workforce.

This paper has highlighted factors and the need to reduce delays by client, consultants and contractors. Clients should make progress in payments to contractors on time, recruit competent project manager, and on time preparation and procurement of needed materials to the contractors. Consultants have to try to manage the project professionally, complete and prepare design on time, using professional specialists and implementation of accurate per-design for minimizing future changes. Contractors need to available source of finance during construction project, proper materials procurement, and developing human resources.

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Ranking of delay factors in multistory building projects by using statistical software

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Abstract— Time is one of the major considerations throughout project management life cycle and can be regarded as one of the most important parameters of a project and the driving force of project success. Time delay is a very frequent phenomenon and is almost associated with nearly all constructing projects. However, little effort has been made to curtail the phenomenon, this research work attempts to identify, investigate, and rank factors perceived to affect delays in the Tamilnadu construction projects with respect to their relative importance so as to proffer possible ways of coping with this phenomenon. To achieve this objective, researcher invited practitioners and experts, comprising a statistically representative sample to participate in a structured questionnaire survey. Brain storming was taken into consideration, through which a number of delay factors were identified in construction projects. Totally, forty five (45) factors were short-listed to be made part of the questionnaire survey and were identified and categorized into nine (8) major categories. The survey was conducted with experts and representatives from private, public, and local general construction firms. The data were analyzed using statistically package of the social science (SPSS), ranking and simple percentages. According to the case study results, the most contributing factors and categories to delays were discussed, and some recommendations were made in order to minimize and control delays in construction projects. Also, this paper can serve as a guide for all construction parties with effective management in construction projects to achieve a competitive level of quality and a time effective.

I. INTRODUCTION

In most countries, experience and the literature revealed that successful construction projects should be completed before project due dates and within budget. Therefore, causes of time delay are of critical importance to the profitability of most construction projects. Many researchers, in the literature, have identified these problems as factors that affect the delay in construction projects and will affect company's performance and overall economy of the country as well. The delay in construction projects by many factors is usually linked to the performance of time, cost, and quality. Meanwhile, identification and evaluating factors causing delay in construction projects have been carried out in the last decade; however, a deeper understanding is still needed to improve that.The outcomes can be used by not only local, but also international industry practitioners, who may be further interested in venturing into potential mega scale projects, but possess no prior practical knowledge of the construction industry specially construction firms in Egypt. The outcomes can help all practitioners to develop wider and deeper perspective of factors causing delay in construction projects and provide guidance to projects and construction managers for efficient solutions. The literature has identified several factors causing delay in construction projects that the researcher has explored in this study. This research ranks the factors causing delay in construction projects in Egypt and explores them by using statistical methods. The following sections present the literature review, research methodology, results with discussions, and conclusions with recommendations.

1. AIM

The aim of this project is to identify the causes of delay in multistory building construction and how to be avoided and control based on the identified factors causing delay of construction process.

2. OBJECTIVES

- To find out the factors that causes construction projects delay.
- To investigate the effects of construction projects delay.
- To determine the risks associated with construction projects delay.

II. LITERATURE REVIEW

1. Asish Ram and Dr. Pratheeba Paul (2015) "Study on Construction Sequence Delay for Road Infrastructure Projects"

Delays can lead to many negative effects such as lawsuits between owners and contractors, increased costs, loss of productivity and revenue, and contract termination. The gathered data are analyzed through Relative Importance Index (RII) and the delay causes are ranked as per their significance. Most of the government initiated infrastructure projects are delay and get finished years after there scheduled completion. The delay in land acquisition is an owner or client related delay factor that is an excusable type of delay.

2. Nitish Kumar and Peer Hilal Ahmad (2016) "A Study on Delay of Construction projects in India

The development of country the construction the construction industry is the main ingredients for an economy. In India, most of the projects are executed through contracts which are generally not easy to comprehend. The primary objective during the construction process is to complete the project within budget, while meeting established quality requirements and other specification. Adopt new approaches to contracting, such as construction management & design-build type of contracts

3. Alena Vasilyeva-Lyulina, Masamitsu Onishi and Kiyoshi Kobayashi (2015) "Delay Analysis Methods For Construction Projects: Mathematical Modelling"

This paper aim to formalizing delay analysis methods commonly applied in practice employing the mathematical language**.** The damages caused by a projects delay in compensated by the contractor in principles in the form of liquidated damage. Delay takes only three forms; 1.delay to commencement, 2.extended duration, 3.suspension during performance**.** Formalization of the delay analysis method. This study proposed a formal description of delay analysis methods that would be applicable to any types of them so that delay analysts can avoid any confusion caused by name approach.

4. Towhid Pourrostam and Amiruddin Ismail (2012) "Causes and Effects of Delay in Iranian Construction Projects"

The aim of this paper is to identify 28 main causes and 6 effects of delay in Iranian construction projects. A questionnaire survey was conducted to solicit the causes of delay from consultants and contractors viewpoint. The perspective of contractors and consultants has been analyzed to rank the causes of delays based on their Relative Importance Index. Clients should make progress in payments to contractors on time, recruit competent project manager, and on time preparation and procurement of needed materials to the contractors.

5. Kasimu Alhaji Mohammed and Abubakar Danladi Isah(2012)"Causes of Delay in Nigeria Construction Industry"

The aim of this paper is to investigate the causes of delay in Nigeria construction industry. The data collected was analyzes in rating form to determine the most causes of delay in the construction projects. 150 questionnaires were distributed and only 127 questionnaires were filled correctly. Based on the mean value criterion, the first ranking seemed that improper planning, Lack of effective communication as the second ranked factor and Shortage of supply i.e. steel, concrete, etc. and Design Errors.

6. M.Haseeb,Xinhai-Lu, Aneesa Bibi, Maloof-ud-Dyian and Wahab Rabbani (2011)"Problems of Projects and Effects of Delays in the Construction Industry of Pakistan"

This paper covers the delay factors and causes of delay and some suggestion for reducing these delays in large construction projects in Pakistan. There were two part of the questionnaire, Part A, Part B. Part A asked about the respondent's personal information, where he is client, consultant, contractor, subcontractor etc. Part B asked about the information related to causes and factors of delay in large construction projects of Pakistan. Most factors related to consultant it is due to not understanding the client necessities, not having proper project information, absence of some detail in drawing etc.

7. Murali Sambasivan,Yau Wen Soon (2007) "Causes and effects of delays in Malaysian construction industry"

This study has also establishment an empirical relationship between each cause and effects. In this research we identify major causes of delay and categorized them as client-related, contractor related, consultant related, material related, labor-related contract- related and external factors. Relatively importance index method. We also studied the empirical relationship between the causes and effects of delays. We isolated the causes of delay for each of effects.

8. Musirikare Mihigo Amandin and Julius Warren Kule (2016)"Project Delay on Cost Overrun Risks: A Study of Gasabo District Construction Projects Kigali, Rwanda"

The major causes of project delays and costs/risks that arise from project delays when implementing public construction projects. The study adopted a descriptive survey research design. Data were collected using open-ended questionnaire. This involved collecting data from construction project contractors, consultants or officers during the period starting from 2009 till 2012in Gasabo,a district in Kigali, Rwanda. In addition, when construction projects' expected or planned cost is increased, a

simultaneous increase in their relative real cost must take place.

9. Megha Desai and Rajiv Bhatt (2013)"Critical Causes of Delay in Residential Construction Projects: Case Study of Central Gujarat Region of India"

This paper suggests an approach to carry out ranking of causes of delay by two different techniques: Relative importance index and Importance index based on degree of severity and degree of frequency and also discuss about the ranking of the causes. Delay on construction projects are a universal phenomenon. They are almost always accompanied by cost and time overrun. The delay in construction projects in India is studied through field survey. It studied frequency, severity and importance and relative importance of the causes of delay.

10. Mohamed M. Marzouk and Tarek I. EI-Rasas (2014)" Analyzing delay causes in Egyptian construction projects"

This research presents a list of construction delay causes from literature. The feedback of construction experts was obtained through interviews. Statistical analysis is carried out using analysis of variance ANOVA method to test delay causes, obtained from the survey. The feedback of construction experts was obtained through interviews and surveys. Frequency Index, Severity Index, and Importance Index are calculated and according to the highest values of them the top ten delay causes analysis of construction projects in Egypt are determined.

III. RESEARCH METHODOLOGY

This chapter comprises of the method and the design that was used to conduct the research. It's a quantitative research in which the data was collected using questionnaires. The population was made of clients, contractors and consultants who were selected by random sampling and convenience sampling technique. There was collection of both primary and secondary data. The primary data was obtained using questionnaires while the secondary data was gathered from the literature. In addition this chapter also presents the questionnaire design, the different sections of the questionnaires, the scale as well as the pilot study that was conducted to ascertain the reliability of the questionnaire. Research methodology chosen for this study comprised of intensive literature review, mail questionnaire to building construction stake holders in Sudan and a statistical analysis of the Survey.

Fig1. METHODOLOGY CHART

3.1 RESEARCH DESIGN

The research was designed to get opinions from clients, consultants and contractors other construction related companies in regards to the factors causing delays, effects of delays, as well risks associated with construction delays. The possible causes, effects and risks of delays were identified from the literature and these factors were tested with the stakeholders of the Sudanese construction industry. A total of 45 delay factors were identified from the literature and stake holders of the indian construction industry were asked to give their opinion on these causes in the form of ranking. Also effects of construction projects delay were also identified from the literature and questions were designed according to these factors to get the opinion from stake holders of Sudanese construction industry. Similarly, risks factors associated with construction projects delays were also identified.

3.2 POPULATION AND POPULATION SIZE

The population was made of consultants, contractors with over 10years of experience in the construction industry and private clients or owners. Moreover all respondents had attained tertiary education. This implied the high position, lengthy years of work experience and educational background provided our respondents with enough knowledge of the construction industry with issues relating to causes, effects and risks of construction delay. The population size consisted of 100 respondents, which included 26 contractors, 24 consultants,18 owner, 09 clients, 23 others. The population size was limited to this number to effectively maximize the time and cost allocated for the research since the questionnaires had many questions and will be time consuming which might discourage some respondents from participating. Also the wide nature of the questionnaire may not be within the competence of

some construction stakeholders. However effective selection of the target respondents with high competence and experience proved to shield these weaknesses.

3.3 DATA COLLECTION

This is referred to as the gathering or the collection of information from customized target respondents to suitably answer the research questions or the research objectives or give answers to findings. In this study, the data was obtained using 2 different methods.

3.3.1 Primary data collection

The primary data refers the first hand information obtained by the researcher himself in his or her study. This information is made available for the first time only by the researcher. The information can be collected through direct personal investigations, through respondents, and survey using questionnaires. The collection modes could also be through; emails, personal interview, phone interview and self-administered survey. The advantages of this method of data collection include; reliability and accuracy and moreover it is a better method for intensive investigation. On the other hand, the disadvantages will be high cost and too much time spent, and the method is not suitable for extensive enquiry. Because of the quantitative nature of our study, the primary data was collected in the survey by making use of questionnaires and also telephone interviews. The questionnaires were emailed to our target respondents who were expected to fill the soft copy of the questionnaires and returned them by emails.

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3.4 QUESTIONNAIRES

In order to determine the perception of different stake holders in Sudan construction industry regarding factors causing delays, a questionnaire was developed. This was the main tool used to collect the data from our target respondents. The questionnaire was structured into 8 sections to meet all 4 research objectives.

For questions relating to mitigating risks due to construction delays, a total measures were identified from the literature and the questionnaires were design using the 5 point Likert scale to determine the effectiveness of each of these measures.

Table 1. Five Point Likert Scale

Extremely Significant	(5)
Very Significant	(4)
Moderately Significant	(3)
Slightly Significant	(2)
Not Significant	(1)

IV. DATA ANALYSIS AND RESULT

INTRODUCTION OF SPSS

SPSS is a Windows based program that can be used to perform data entry and analysis and to create tables and graphs. SPSS is capable of handling large amounts of data and can perform all of the analyses covered in the text and much more. SPSS is commonly used in the Social Sciences and in the business world, so familiarity with this program should serve you well in the future. SPSS is updated often. This document was written around an earlier version, but the differences should not cause any problems. If you want to go further and learn much more about SPSS, I strongly recommend Andy Field's book (Field, 2009, *Discovering statistics using SPSS*). Those of us who have used software for years think that we know it all and don't pay a lot of attention to new features. I learned a huge amount from Andy's book.

RESULT OF SPSS

Sl.No.	Factors that the delay in construction	SPSS value	Rank
1.	Poor communication & co-ordination by owner and other parties	2.26	34
2.	Misunderstandings in technical dealing with tenders & contractors	2.40	19
3.	Conflict in joint ownership	2.17	38
4.	Delay in payment of completed work by owner	2.76	6
5.	Late revising and approving relevant documents by owner	2.48	12
6.	Less authority given to consultant to take decision	2.28	32
7.	Unclear and inadequate details in drawings	2.28	31
8.	Communication barriers faced by consultant	2.04	44
9.	Total quality management by consultant	2.23	39
10.	Inadequate site information given to consultant	2.40	24
11.	Ineffective planning and scheduling of project	2.57	12
12	Delay in preparation of shop drawing and material sample	2.37	19
13.	Delay in site mobilization	2.54	15
14.	Compatibility of contractor with new software's	2.26	37
15.	Risk analysis & management by contractor	2.35	26
16.	Source updating in the design engineering documents & related	2.43	32
17.	Shortage of construction materials in market	2.93	2
18.	Delay in material delivery	2.89	3
19.	Changes in quality of material	2.74	7
20.	Escalation of material prices	2.92	1
21.	Material damage in storage	2.42	22
22.	Slow process of material selection	2.57	12
23.	Shortage of labors	2.82	5
24.	Unqualified workforce	2.61	11
25.	Equipment availability and failure	2.44	17
26.	Shortage of recent technology equipment	2.33	26
27.	Delay in equipment delivery	2.57	10
28.	Poor labor supply & labor productivity	2.64	8
29.	Traffic control at site	1.88	45
30.	Insufficient data collection and survey	2.21	41
31.	Accidents on site	2.29	35
32.	Rework due to error in construction	2.55	15
33.	Problem due to existing structures	2.45	23
34.	Unforeseen ground conditions	2.29	29
35.	Bad weather condition and poor lighting	2.24	39
36.	Environmental changes due to rainy and hot season	2.26	36
37.	Natural disasters (Earthquake, floods etc.,)	2.44	24
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40.	Changes in government regulation & laws	2.61	17
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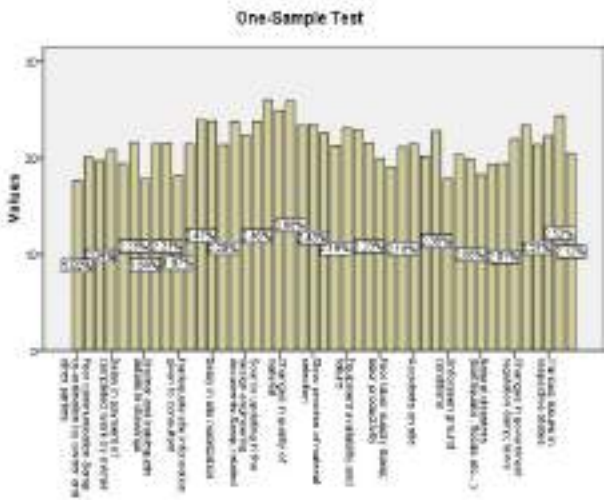
42.	Regulatory changes in building code	2.33	28
43.	Various issues in respective states	2.36	42
44.	Demonetization issue of financial problem	2.88	4
45.	Banking restriction	2.62	9



V.RECOMMENDATION AND CONCLUSION

According to abovementioned findings, following points can be recommended in order to minimize and control delays in construction projects: (1) Shortage of construction materials in market,(2) Escalation of material prices, (3) Delay in material delivery, (4) Demonetization issue of financial problem,(5) Shortage of labors,(6) Delay in payment of completed work by owner, (7) Changes in quality of material, (8) Poor labor supply & labor productivity, (9) Banking restriction (10) Unqualified workforce

This paper has highlighted factors and the need to reduce delays by client, consultants and contractors. Clients should make progress in payments to contractors on time, recruit competent project manager, and on time preparation and procurement of needed materials to the contractors. Consultants have to try to manage the project professionally, complete and prepare design on time, using professional specialists and implementation of accurate per-design for minimizing future changes. Contractors need to available source of finance during construction project, proper materials procurement, and developing human resources.

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Treatment Of Textile Dyeing Effluent By Natural Adsorbents Using Ipomoea Carnea

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Abstract:

In the present paper natural adsorbent Ipomoea carnea leaf was used for removal of color from waste effluent of textile industry.Wastewater pollution is the major environmental issue of the textile industries. It is the serious problem in almost every industry using the dyes to color their product. Removal of color and heavy metal ions from the water is essential for public health. Various coagulants are being used for removal of color by coagulation process (jar test). Among these alum is used because of its removal efficiency. The % of color removal in the effluent after coagulation was found by using UV-Visible Spectrophotometer. Among these natural adsorbent obtained from leaf like Ipomoea carnea is used due to its large surface area, high adsorption capacity and surface reactivity. The % absorption was estimated using UV-Visible Spectrophotometer. The metal ion concentration present in the effluent after absorption was found using Atomic Adsorption Spectroscopy. Thus the % of heavy metal ion removal was calculated. The result confirms that the color removal efficiency increases as the coagulant dosage increases .Thus it is observed that the percentage removal of Pb and Cd ions was found to be higher for Ipomoea carnea adsorbent.

Keywords— Textile effluent, Cadmium, Lead, coagulation, Adsorbent, Ipomoea carnea, AAS.

I.INTRODUCTION:

The textile dyeing industry consumes large quantities of water and produces large volumes of wastewater from different steps in the dyeing and finishing processes. Wastewater from printing and dyeing units is often rich in color, containing residues of reactive dyes and chemicals, and requires proper treatment before being released into the environment. “Color the earth beautiful and kill it with sweet poison” Strong color of the textile waste water is the most serious problem of the textile industrial effluent. Non-critical metals, like sodium, potassium, magnesium and calcium, belong to class A, whereas toxic metals, generally, belong to class B or border line. But essential trace metals, like Fe, Zn, Co, etc. also belong to border line.

Criteria	**Elements**
Non-critical	Na, K, Mg, Ca, H, O, N, P, Fe, S, Cl, Br, F, Li, Rb, Sr, Al, Si
Toxic, insoluble/rare	Ti, Hf, Zr, W, Nb, Ta, Re, Ga, Lanthanides,Os, Rh, Ir, Ru, Actinides
Toxic and relatively abundant	Be, Co, Cu, Zn, Ni, Sn, As, Se, Te, Pb, Ag, Cd, Pt, Au, Hg, Pb, Sb, Bi

1.TOXICITY OF CADMIUM

Cadmium is an extremely toxic metal which has no known necessary function in the body. Cadmium toxicity contributes to a large number of health conditions, including the major killer diseases such as heart disease, cancer and diabetes. Cadmium concentrates in the kidney, liver and various other organs and is considered more toxic than either lead or mercury. It is toxic at levels one tenth that of lead, mercury, aluminum, or nickel.Cadmium toxicity is increasing in incidence today for several reasons. Often these industries then pollute water, air and food with this metal.

2.TOXICITY OF LEAD

Lead poisoning has been recognized as a major public health risk, particularly in developing countries. This review provides a comprehensive account of recent updates describing health effects of lead exposure, relevant biomarkers and mechanisms involved in lead toxicity. It also updates the readers about recent advances in chelation therapy and newer therapeutic strategies, like nanoencapsulation, to treat lead induced toxic manifestations.

3.COAGULATION

A clumping of particles in wastewater to settle out impurities, it is often induced by chemicals such as lime, alum and iron salt. Coagulation is the most common treatment for decolorization. Many of the contaminants in water and wastewater contain matter in the colloidal form. .So they need special treatment to remove them from the aqueous phase. This destabilization of colloids is called “coagulation”

COAGULANTS

Coagulant is an agent that cause the liquid or solid to coagulate. The amount of coagulant required for coagulation depends on the turbidity of the wastewater

a) Inorganic coagulants
There are various inorganic coagulants which can be used as coagulants such as ferric chloride, lime, alum, magnesium chloride.
b) Organic coagulants
Organic coagulants including poly electrolytes, synthetic polymers and natural polymer can be used for coagulation process.

4. ADSORPTION

Adsorption is a process that occurs when a gas or liquid solute accumulates on the surface of a solid or a liquid (adsorbent), forming a molecular or atomic film (the adsorbate). It is different from absorption, in which a substance diffuses into a liquid or solid to form a solution
Physisorption or physical adsorption is a type of adsorption in which the adsorbateadheres to the surface only through Van der Waals (weak intermolecular) interactions, which are also responsible for the non-ideal behaviour of real gases.

Chemisorption is a type of adsorption whereby a molecule adheres to a surface through the formation of a chemical bond, as opposed to the Van der Waals forces which cause physisorption.

II.MATERIALS AND DESCRIPTION

Fig 1.

Binomial name : Ipomoea carnea
Ipomoea carnea, the pink morning glory, is a species of morning glory. This flowering plant has heart shaped leaves that are a rich green and 6-9 inches long. It can be easily grown from seeds which are toxic and it can be hazardous to cattle; the toxicity is related to the bioaccumulation of selenium spices in leaves but mostly in seeds.

III.METHODOLOGY

1. SAMPLE COLLECTION

The textile dye wastewater was collected from a private small-scale industry located at Tiruppur, Tamilnadu, India. The wastewater was analysed for various parameters as per the procedure. The wastewater was stored at room temperature (35°C) in airtight plastic containers.

Fig 2.Collected Sample

2. SAMPLE ANALYSIS

The parameters analyzed includes the following.

- pH
- Turbidity
- Chemical oxygen demand
- Total suspended solids
- Total dissolved solids
- Total solids

3. REAGENTS AND STANDARDS

Analytical grade nitric acid, hydrochloric acid and hydrogen peroxide (Merck. India were used as received.Standard sample solutions of Cd, Cu, Pb, Mn, Fe, Mg, Zn and Ni (1000 mg/ml) were obtained from Merck (Germany). All the solutions were prepared using triply distilled water.
PROCEDURE

Heavy metals like Cd, Cu, Pb and Minerals like Fe, Na, Mg, K and Zn, in effluent samples were analyzed using atomic absorption spectrophotometer (AA 6300, Shimadzu, Japan) equipped with flame and graphite furnace. Atomic absorption spectrometry (AAS) uses the phenomenon that atoms in the ground state absorb light of a specific wavelength; characteristic of the particular atom, when the light passes through an atomic vapour layer of the element to be determined. coagulation –flocculation by jar test.

4. PREPARATION OF ADSORBENTS

Initially Ipomoea carnea leaves were washed repeatedly by using distilled water to remove moisture and soluble impurities. Then Ipomoea carnea leaves kept in hot air oven at 110 degree,for 4-5hrs till leaves turn pale yellow. Then crushed and screen by 10-15um mesh size.The leaves powder washed to remove moisture and free acid and kept in hot air oven at 110 degree for 2-3 hrs.After drying powder was mixed with phosphoric in borosil beaker and kept in furnace at 260 degree for 15-20 minutes.The heating period depend on atmospheric

S.NO	Dose of the alum (g/L)	% removal of color
1	0.2 g/L	22.61%
2	0.4 g/L	42.77%
3	0.6 g/L	63.87%
4	0.8 g/L	77.44%
5	1 g/L	86.26%
6	1.2 g/L	97.45%

temperature then solution was cooled & repeatedly washed using hot water to remove free acid and moisture. They are washed 7 times and kept in a hot air oven for 2hrs.The prepared black colored adsorbent is kept in bottle for further use. The sample is removed and cooled. After cooling, the sample is washed repeatedly using hot water, The washing is continued till the color of the water remains blue while adding EBT.EBT is added to check whether there is presence of impurities.Reddish brown indicates presence of impurities, Blue indicates absences of impurities. Then the sample is kept in hot air oven for 2hrs to dry. Thus the black colored adsorbent is obtained.

5. MEASUREMENT OF ABSORPTION BY SPECTROPHOTOMETRY PROCEDURE:

The sample of 50ml was taken in each of 5 beakers. The samples were examined in UV-visible spectrophotometer to check the % of absorption.0.1g of Ipomoea carnea adsorbent was added in each beakers and it was kept for 24hr periodic shaking. After 24hrs % of absorption was measured. Same procedure was followed for 0.2g, 0.3g, 0.4g and 0.5g to study the effect of absorption.

IV RESULT AND DISCUSSION

Table 4.1: Characterization of sample before coagulation process:

S.NO	Parameters	Result	WHO
1	pH	8.60	7-8.5
2	Turbidity	358NTU	5-50NTU
3	Total solids	11000mg/l	350-2000mg/l
4	TDS	10625mg/l	500-2000mg/l
5	TSS	375mg/l	500-1000mg/l
6	COD	960mg/l	250mg/l

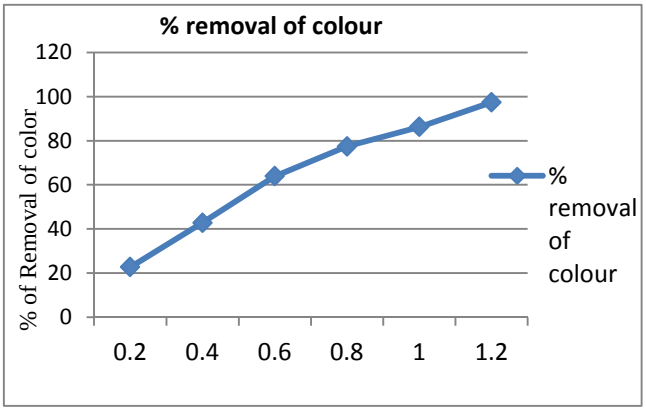
Effect of the dose rate

The removal of color was studied with the different dose of alum(0.2g/L to 1.2g/L) with rapid stirring for about 10min and gentle stirring for about 20min. The result are given in the table and pictorially represented in figure

Table 4.2: Effect of the Dose rate of the Coagulant alum on Percentage Removal of Color

It is noted that the removal of color increases as the coagulant dosage increases. The higher removal efficiency (97.45%) with the dosage of alum(1.2g/L)

S.NO	Heavy Metals	Concentration (ppm)	WHO (ppm)
1	Cadmium	0.76	0.003
2	Copper	0.45(BDL)	1.000
3	Lead	0.15	0.010
4	Iron	0.7(BDL)	0.1-1.0
5	Chromium	0.12	0.05



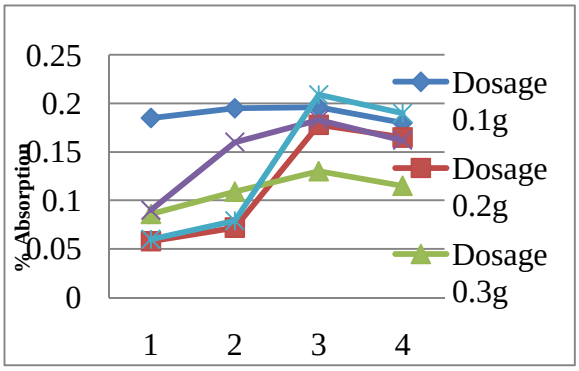
(ii) Determination of Heavy metals by AAS

BDL – Below Detectable Limit
WHO – World Health Organization

Spectrophotometer Readings for % Absorption using Ipomoea carnea Adsorbent

Table 4.4: Spectrophotometer Readings for % Absorption

Day	Dosage 0.1g	Dosage 0.2g	Dosage 0.3g	Dosage 0.4g	Dosage 0.5g
1st day	0.185%	0.058%	0.086%	0.090%	0.060%
2nd day	0.195%	0.072%	0.109%	0.160%	0.079%
3rd day	0.196%	0.178%	0.130%	0.183%	0.209%
4th day	0.180%	0.165%	0.115%	0.162%	0.190%



Result for Cadmium from Atomic Absorption Spectroscopy using Ipomoea carnea Adsorbent

Table 4.5: % Removal of cadmium

S.NO	Dose of the Ipomoea carnea (g/L)	Concentration (ppm)	Percentage of Removal
1	2 g/l	0.0081	99.46%
2	4 g/l	0.0059	99.60%
3	6 g/l	0.0047	99.68%
4	8 g/l	0.0015	99.90%
5	10 g/l	0.0012	99.92%

Result for Lead from Atomic Absorption Spectroscopy Ipomoea carnea Adsorbent

Table 4.6: % Removal of lead

S.NO	Dose of the Ipomoea carnea (g/L)	Concentration (ppm)	Percentage of Removal
1	2 g/l	0.1130	91.22%
2	4 g/l	0.1066	92.68%
3	6 g/l	0.1041	93.10%
4	8 g/l	0.0977	94.56%
5	10 g/l	0.0953	94.98%

V. CONCLUSION

The removal of toxic chemicals from the waste water using low cost adsorbent prepared from leaf like Ipomoea carnea is more effective.It is the very cheap method for treating the waste water, so it is very useful treating the waste water from the small scale industry.

VI. REFERENCES

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Treatment Of Textile Dyeing Effluent By Natural Adsorbents Using Prosopis Juliflora

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[2]Assit.prof. Department of Civil Engineering , P.S.R.Engineering college , Sivakasi

Abstract:

Wastewater pollution is the major environmental issue of the textile industries. It is the serious problem in almost every industry using the dyes to color their product. Removal of color and heavy metal ions from the water is essential for public health. Various coagulants are being used for removal of color by coagulation process (jar test). Among these alum is used because of its removal efficiency. The % of color removal in the effluent after coagulation was found by using UV-Visible Spectrophotometer. Among these natural adsorbent obtained from leaf like Prosopis juliflora is used due to its large surface area, high adsorption capacity and surface reactivity. The % absorption was estimated using UV-Visible Spectrophotometer. The metal ion concentration present in the effluent after absorption was found using Atomic Adsorption Spectroscopy. Thus the % of heavy metal ion removal was calculated. The result confirms that the color removal efficiency increases as the coagulant dosage increases .Thus it is observed that the percentage removal of Pb and Cd ions was found to be higher for Prosopis juliflora adsorbent.

Keywords— Textile effluent, Cadmium, Lead, coagulation, Adsorbent, Prosposis juliflora, AAS.

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The textile dyeing industry consumes large quantities of water and produces large volumes of wastewater from different steps in the dyeing and finishing processes. Wastewater from printing and dyeing units is often rich in color, containing residues of reactive dyes and chemicals, and requires proper treatment before being released into the environment. " Color the earth beautiful and kill it with sweet poison " Strong color of the textile waste water is the most serious problem of the textile industrial effluent. Non-critical metals, like sodium, potassium, magnesium and calcium, belong to class A, whereas toxic metals, generally, belong to class B or border line. But essential trace metals, like Fe, Zn, Co, etc. also belong to border line.

Criteria	Elements
Non-critical	Na, K, Mg, Ca, H, O, N, P, Fe, S, Cl, Br, F, Li, Rb, Sr, Al, Si
Toxic, insoluble/rare	Ti, Hf, Zr, W, Nb, Ta, Re, Ga, Lanthanides,Os, Rh, Ir, Ru, Actinides
Toxic and relatively abundant	Be, Co, Cu, Zn, Ni, Sn, As, Se, Te, Pb, Ag, Cd, Pt, Au, Hg, Pb, Sb, Bi

Table 1.2 Elemental composition of an adult human being (Bhattacharya and Venkobachar 1984)

Element	Mass(g)	Element	Mass(g)
Aluminium	0.100	Iron	004.20
Arsenic	0.010	Lead	000.08
Antimony	0.070	Magnesium	035.00
Barium	0.020	Manganese	000.02
Boron	0.010	Nickel	000.01
Cadmium	0.030	Potassium	140.00
Calcium	1050	Sodium	105.00
Chromium	0.005	Tin	000.03
Cobalt	0.003	Vanadium	000.02
Copper	0.110	Zinc	002.30

1. TOXICITY OF CADMIUM

Cadmium is an extremely toxic metal which has no known necessary function in the body. Cadmium toxicity contributes to a large number of health conditions, including the major killer diseases such as heart disease, cancer and diabetes. Cadmium concentrates in the kidney, liver and various other organs and is considered more toxic than either lead or mercury. It is toxic at levels one tenth that of lead, mercury, aluminum, or nickel.Cadmium toxicity is increasing in incidence today for several reasons. Often these industries then pollute water, air and food with this metal.

2. TOXICITY OF LEAD

Lead poisoning has been recognized as a major public health risk, particularly in developing countries. . This review provides a comprehensive account of recent updates describing health effects of lead exposure, relevant biomarkers and mechanisms involved in lead toxicity. It also updates the readers about recent advances in chelation therapy and newer therapeutic strategies, like nano encapsulation, to treat lead induced toxic manifestations.

3. COAGULATION

A clumping of particles in wastewater to settle out impurities, it is often induced by chemicals such as lime, alum and iron salt. Coagulation is the most common treatment for decolorization. Many of the contaminants in water and wastewater contain matter in the colloidal form. .So they need special treatment to remove them from the aqueous phase. This destabilization of colloids is called “coagulation”

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Coagulant is an agent that cause the liquid or solid to coagulate. The amount of coagulant required for coagulation depends on the turbidity of the wastewater

a) Inorganic coagulants

There are various inorganic coagulants which can be used as coagulants such as ferric chloride, lime, alum, magnesium chloride.

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Organic coagulants including poly electrolytes, synthetic polymers and natural polymer can be used for coagulation process.

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Chemisorption is a type of adsorption whereby a molecule adheres to a surface through the formation of a chemical bond, as opposed to the Van der Waals forces which cause physisorption.

II.MATERIALS AND DESCRIPTION:

Fig 1.

Binomial name : Prosopis juliflora

Prosopis juliflora has become an invasive weed in several countries where it was introduce. It is considered a noxious invader in Ethiopia Hawaii Sri Lanka, Jamaika the middle East, India, Nigeria, Sudan, Somalia .It is also a major weed in the southwestern united states. It is hard and expansive to remove as the plant can regenerate from the roots.

III.METHODOLOGY:

1. SAMPLE COLLECTION:

The textile dye wastewater was collected from a private small-scale industry located at Tiruppur, Tamilnadu, India. The wastewater was analysed for various parameters as per the procedure. The wastewater was stored at room temperature (35°C) in airtight plastic containers.

Fig 2.Collected Sample

2. SAMPLE ANALYSIS:

The parameters analyzed includes the following.

- pH
- Turbidity
- Chemical oxygen demand
- Total suspended solids
- Total dissolved solids
- Total solids

3. REAGENTS AND STANDARDS:

Analytical grade nitric acid, hydrochloric acid and hydrogen peroxide (Merck. India were used as received.Standard sample solutions of Cd, Cu, Pb, Mn, Fe, Mg, Zn and Ni (1000 mg/ml) were obtained from Merck (Germany). All the solutions were prepared using triply distilled water.

PROCEDURE:

Heavy metals like Cd, Cu, Pb and Minerals like Fe, Na, Mg, K and Zn, in effluent samples were analyzed using atomic absorption spectrophotometer (AA 6300, Shimadzu, Japan) equipped with flame and graphite furnace. Atomic absorption spectrometry (AAS) uses the phenomenon that atoms in the ground state absorb light of a specific wavelength; characteristic of the particular atom, when the light passes through an atomic vapour layer of the element to be determined. coagulation –flocculation by jar test.

4. PREPARATION OF ADSORBENTS:

Initially Prosopis Juliflora leaves were washed repeatedly by using distilled water to remove moisture and soluble impurities. Then Prosopis Juliflora leaves kept in hot air oven at 110degree,for 4-5hrs till leaves turn pale yellow. Then crushed and screen by 10-15um mesh size. The leaves powder washed to remove moisture and free acid and kept in hot air oven at 110 degree for 2-3 hrs. After drying powder was mixed with phosphoric in borosil beaker and kept in furnace at 260 degree for 15-20 minutes. The heating period depend on atmospheric temperature then solution was cooled & repeatedly washed using hot water to remove free acid and moisture. They are washed 7 times and kept in a hot air oven for 2hrs.The prepared black colored adsorbent is

kept in bottle for further use. The sample is removed and cooled. After cooling, the sample is washed repeatedly using hot water, The washing is continued till the color of the water remains blue while adding EBT.EBT is added to check whether there is presence of impurities. Reddish brown indicates presence of impurities, Blue indicates absences of impurities Then the sample is kept in hot air oven for 2hrs to dry.Thus the black colored adsorbent is obtained

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The sample of 50ml was taken in each of 5 beakers. The samples were examined in UV-visible spectrophotometer to check the % of absorption.0.1g of Prosopis Juliflora adsorbent was added in each beakers and it was kept for 24hr periodic shaking.After 24hrs % of absorption was measured.Same procedure was followed for 0.2g, 0.3g, 0.4g and 0.5g to study the effect of absorption.

IV.RESULT AND DISCUSSION:

Table 3.1: Characterization of sample before coagulation process:

S.NO	Parameters	Result	WHO
1	pH	8.60	7-8.5
2	Turbidity	358NTU	5-50NTU
3	Total solids	11000mg/l	350-2000mg/l
4	TDS	10625mg/l	500-2000mg/l
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6	COD	960mg/l	250mg/l

1. **Effect of the dose rate**:

The removal of color was studied with the different dose of alum(0.2g/L to 1.2g/L) with rapid stirring for about 10min and gentle stirring for about 20min. The result are given in the table and pictorially represented in figure

Table 3.2: Effect of the Dose rate of the Coagulant alum on Percentage Removal of Color

S.NO	Dose of the alum (g/L)	% removal of color
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2	0.4 g/L	42.77%
3	0.6 g/L	63.87%
4	0.8 g/L	77.44%
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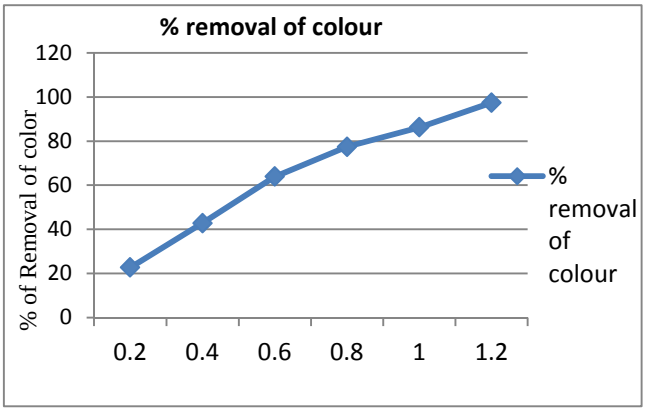
It is noted that the removal of color increases as the coagulant dosage increases. The higher removal efficiency (97.45%) with the dosage of alum(1.2g/L)



2. **Determination of heavy metals by atomic absorption spectrometry**

Table 3.3: Concentration of heavy metals

S.NO	Heavy Metals	Concentration (ppm)	WHO (ppm)
1	Cadmium	0.76	0.003
2	Copper	0.45(BDL)	1.000
3	Lead	0.15	0.010
4	Iron	0.7(BDL)	0.1-1.0
5	Chromium	0.12	0.05

BDL – Below Detectable Limit
WHO – World Health Organization

3. Spectrophotometer readings for % absorption using prosopis juliflora adsorbent

Table 3.4: Spectrophotometer readings for % absorption

Day	Dosage 0.1g	Dosage 0.2g	Dosage 0.3g	Dosage 0.4g	Dosage 0.5g
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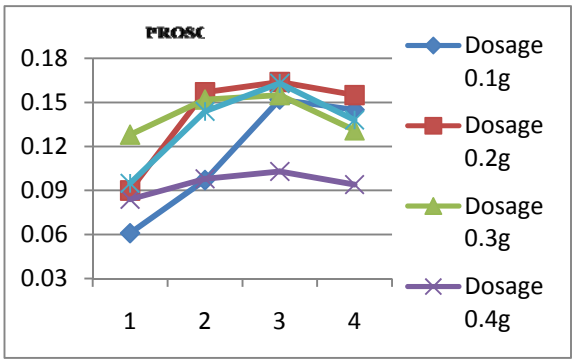

4. Result for Cadmium from Atomic Absorption Spectroscopy using Prosopis juliflora Adsorbent

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S.NO	Dose of the Prosopis Juliflora (g/L)	Concentration (ppm)	Percentage of Removal
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3	6 g/l	0.1041	93.10%
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5	10 g/l	0.0953	94.98%

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An Investigation of Risk Factors Affecting Building Construction Projects

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Abstract— Construction industry in India is rapidly increasing day by day with lots of innovative techniques being added for the rapid construction of the projects. But at the same time construction industry is highly risk prone, with complex and dynamic project environments creating an atmosphere of high uncertainty and risk. Management of risk is an important step in project success. It is the process of identifying, classifying, analyzing and assessing of risks in a project. Risk management is an activity which integrates recognition of risk, risk assessment, developing strategies to manage it, and mitigation of risk using managerial resources various technical, socio-political and business risks affect the industry at various stages. As a result, the people working in the industry bear various failures, such as, failure of abiding by quality and operational requirements, cost overruns and uncertain delays in project completion. The aim of our work is to identify and evaluate current risks and uncertainties in the building construction industry through literature survey and finding the possible measures to the building construction in order to avoid the identified factors in the future projects.

Keywords:- Risk Management, Construction industry, Risk assessment

I. INTRODUCTION

Numbers of various projects at various scales are being implemented in India with involvement of various experts team for proper execution so that the progress of work at various stages should be executed as per the planned line of action so as to avoid the risk and the uncertainty in the working phase of the projects. All the above can be done only if the project management team along with other works together on a common platform, and hence project management is said to be the science which applies skills, tools and techniques to fulfill the project activities in a way that the expectations and requirements can be fulfilled without any risk and uncertainty.

Risk management is an integral part of the various process and stages for identifying the different risk associated with a project. In its broader manner it can be said to look for more positive events in the project thus by reducing or minimizing the impact of negative or unwanted events so as to reduce the probable risk. No project or industry is risk free, all of them bears risk at various stages at different amount and varies from one activity to other.

Every construction project involve various risk factors which have various impacts on projects right from the start of the project till its completion. Construction Industry in India is one of the most important sector involving with various stages involved right from the starting phase till the completion phase and even after successful completion of the project.

II. OBJECTIVE

The main objective of this project is to identify the key risk factor which affects the building construction projects.

III. LITERATURE REVIEW

To determine the risk factors, a number of studies has been carried out which are as follows:-

A Study of Risk Factors Affecting Building Construction Projects. P.Patel krishan (Vol.3 Issue 12, Dec 2014)

Critical Factors Influencing to Management Risk in Construction Projects V.Sathishkumar, P.N.Raghunath. (Vol.4 Issue 1, Jan 2015)
Risk Assessment Methods and Application in the Construction Projects. Dr.R.K.Kansal, K. Manoj Sharma(Vol.2 Issue 3, June 2012)
Management of Risk in Construction Projects in Maharashtra. M.G.Bhandari, Dr. P.G.Gayakwad (Vol.3 Issue 1, Jan 2014)
An Investigation into Risk Factors and Preventive Measures in Building Construction Projects in Abuja FCT, Nigeria. Ibrahim, Abdul (Vol.4 Issue 7, July 2014)
Risk Management in Construction Projects, Seyed Hossein Abedian Kalkhoran. (Vol.10 Issue 3, April 2014)
An Assessment of Risk Identification in Large Construction Projects in Iran, Mehdi Tadayon, Mastura Jaafar. (Vol.1 Issue 5, 2012)
Identification and Evaluation of Risk Factors Affecting the Supply Chain Environment of Construction Industry, S.B. Khattak, M. Abas. (Vol.20 Issue 2, 2015)

IV. RISK MANAGEMENT PROCESS

Risk management process consists of following steps:

Fig 1:- Risk Management Process.

Risk Identification:
Risk identification is the first step of risk management process, in which potential risks associated with a construction projects are, identified. Determination of most likely risks affecting the project and documentation of characteristics of each risk is the main task in risk identification. As per my knowledge risk identification is nothing but to accept the risk which would occur at any phase of the project. It helps to understand the risk, its consequences and probability of occurrence. The project team or the risk manager will react to the risk in case of occurrence.

Risk analysis:
Assessment of risks and the possible interactions of risks with project activities to evaluate the possible outcomes of the project. Actually risk can be avoided by not doing part of the project which contains risk or otherwise changing the strategy so as to minimize the risk which would likely to come into the project phase.
Risk response:
It can be defined as response steps for opportunities and threats associated with risks. Risk can be monitored by employing a predictive indicator to watch the project as it approaches a risky point. The risk strategy is to monitor the risk by being part of the test team.
Risk response control**:**
Response to the changes implemented to remove risks throughout the project duration by transferring the risk by means of insurance.

V.IMPORTANCE OF RISK MANAGEMENT

Any Construction project related risk management delivers the following importance:

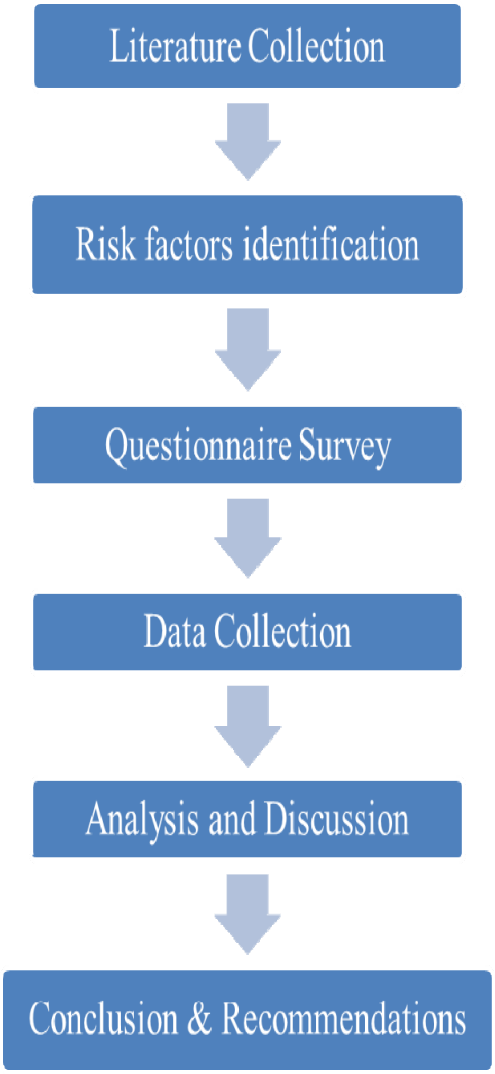
- Helps and Contributes to project success
- Recognizes uncertainty in the project stages and provides forecasts of possible outcomes
- Produces better business outcomes through more informed decision making Positive influence on creative thinking and innovating project future
- Offers better control on less overhead and less time wasted, greater focus on benefits.

VI.ADVANTAGES OF RISK MANAGEMENT

Following are advantages of risk management:

- To achieve the desired objectives
- Reduction of capital cost of the project by minimizing risk in time
- Less uncertainty.

VII.WORK METHODOLOGY



VIII.RISK RESPONSE

In this study Questionnaire survey was developed based on 10 factors in building construction. For each factor the respondent's scale of importance rate using five point scale of 1 to 5 is adopted. It is rated as follows 5=very high; 4=high; 3=medium; 2=low; and 1=very low. From questionnaire survey, a field study was carried out to get feedback from experts in construction industry on the factors identified from literature reviews

S.NO	PARAMETERS	MEAN
1.	Unmanaged cash flow	4.25
2.	Difficulty to get permit	3.58
3.	Poor relation and dispute with partner	3.20
4.	Defective design	3.18
5.	Unavailability of Resources	3.43
6.	Inaccurate Quantities	3.47
7.	Fluctuation in Prices	3.33
8.	Supply of Defective materials	3.66
9.	Improper Security	3.56
10.	Poor Safety Procedures	3.39
11.	Improper Site Investigation	3.79
12.	Lack of Leadership& Technical Staff	3.35
13.	Improper Communication	3.43
14.	Sudden Strikes	3.35
15.	Adverse Weather Conditions	3.14
16.	Disaster Factors	3.33
17.	Higher Staff Turnover	3.25

IX.CONCLUSION

The success of every project depends on how efficiently and effectively them. Risk management will not remove all risks from the projects. Its main objective is to ensure that risks are managed most effectively. The evaluation of critical factor by analyzing and finding the possible measures to the building construction in order to avoid the identified factors in the future projects. The control of risk and risk management is most useful method in construction industry. This kind of study will help the construction industry to work on certain important and most critical factors so that risk can be properly managed.

Acknowledgment

We wish to express our sincere thanks to Dr. S.Shahul Hameed. ME., Ph.D., Head of the Department of Civil Engineering, for his kind advice and constant encouragement. We Record my deep sense of thanks to Project coordinator and always my beloved Guide Mr. T.Vairamuni, M.Tech., Department of Civil Engineering, for his constant help and creative ideas over the period of project work. We would like to extend our warmest thanks to all our Staff members for helping us in this venture. Unflinching support and encouragement from the members of my family, friends in P.S.R ENGINEERING COLLEGE helped us a long way to complete our project work. We must thank them all from depths of our heart.

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Thermal Resistant Concrete Under Elevated Temperature

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Abstract

The need and to cater the demands of the construction industry, extensive and elaborate research work is being carried out in the area of Concrete Technology. Research work have been pursued to develop new variants in concrete like composite concrete, special concrete. In this present study experimental of Mechanical behavior of concrete using steel fiber cum calcium silicate.Steel fiber is used for increasing the tensile strength and impact resistance and calcium silicate is used for fire resistance material, so it is decided to use both the materials to get high strength as well as heat resistance of the structure. Cylindrical specimen were exposed to high temperatures of 300 ^{0}c,400 ^{0}c, and 500 ^{0}c.Physical and mechanical properties of the developed mixes including residual compressive strength, mass losses, and water absorption have been determined. The result shows that the strength and heat resistance of the concrete have increased with the use of steel fibers and calcium silicate.

Keywords: Thermal resistant, High temperature, Residual compressive strength, Mass losses

I. INTRODUCTION

The frequent cases of fire occurrences in buildings have always been of great concern to the society for the risks it poses to both human lives and property. Fires can occur at any time in a building and the safety of occupants and the ability of structures to maintain its integrity are very important to the people. Building codes and regulations specify detailed measures for the safety of structural members in the event of a fire. They categories construction materials with particular emphasis on their fire resistance and recommends fire suppression systems required for various building types. Hence, the objective of fire safety is to protect life and property. The fire safety requirements of materials are based on the ability of structural elements built with the materials to maintain its load-bearing capability at various fire conditions. In other words, the fire resistance rating of a structural member can be said to be proportional to the period of time it can resist in terms of structural integrity and stability to standard fire conditions. Structural members are to be designed to satisfy the requirements of serviceability and safety limit states for various environmental conditions. Fire represents one of the most severe conditions and hence the provision of appropriate fire safety measures for structural members is a major safety requirement in building design. The basis for this requirement can be attributed to the fact that, when other measures for containing the fire fail, structural integrity is the last line of defence. According to the Merriam-Webster dictionary (2012), "A structure is the arrangement of part of elements as dominated by the general character of the whole''. A structure could also be said to be a complex entity, constructed from the arrangements of several parts. In engineering and architecture, a structure is a body or assembly of the body elements to form a system capable of resisting loads. The effects of loads on physical structures are determined through structural analysis. Structures can also be categorised by the type of material used for its construction. Structural engineering depends on the knowledge of materials and their properties, in order to understand how different materials support and resist loads. The choice of what material to use for construction depends on some factors: material properties (strength and durability), cost (acquisition, technology, maintenance, sustainability), aesthetics/taste and constructability. Common structural materials are concrete, steel, bricks, timber, fibre reinforced plastic (FRP) composites. Each of these materials resist fire differently and scientist are working tirelessly to improve their fire rating. Fire resistance can be defined as the ability of structural elements to withstand fire or to give protection from it (IBC, 2006). This includes the ability to confine a fire or for a structure to continue to perform its structural functions after fire incidence or both. Fire Resistance Rating (or fire rating), is defined as the duration of time that an assembly (roof, floor, beam, wall, or column) can endure a "standard fire" as defined in ASTM E 119 (ASTM, 2000).

II. LITERATURE REVIEW

Anthony Nkem (2015)Studied the effects of fire on coconut husk fibre and polypropylene fibre reinforced concrete.0.5% of coconut and polypropylene fibres and exposed to temperatures of 200oC, 400oC, 600oC, 800oC and 1000oC after 7, 14, 21, and 28 days of curing.It can be easily deduced that at 7 days, coconut fibre reinforced concrete has a higher compressive strength and higher fire resistance having as much as 10.29% of strength gain at the ambient temperature and 19.57% residual strength after exposure at 1000oC.It can be easily concluded that the presences of either of the two

types of fibres increases the compressive strength of concrete especially at the lower temperatures up to 400 degree C, with greater increase in the coconut fibre samples than polypropylene sample.The percentage increase in the compressive strength of the concrete samples show that the coconut fibers' produce a higher strength increase over the polypropylene fibers. The addition of both fibers did not just increase the compressive strength, but test results have proved that they also increase the fire resistance property of the concrete.

Abdullah Keyvani (2014)investigated thermal performance and humidity intrusion effects and fire resistance test.Thermal performance was evaluated for different temperatures and humidity for two types of AAC walls with coating and without coating.Fire resistance test was carried out for determining the ability of AAC material to withstand fire in six different temperatures increasing from 100°C to 1000°C. AAC losses its mass and mechanical properties subjected to the high elevated temperature above 500°C

III .MATERIAL COLLECTION

i)CEMENT:

Ordinary Portland cement(53 grade) cement conforming to IS 8112 was used. Various laboratory tests were conducted on cement and the properties such as standard consistency, initial and final setting time, were determined as per IS 4031 and IS 269-1967.The results conform to the IS recommendations.

ii)FINE AGGREGATE:

River sand zone II was used in this study

iii)COARSE AGGREGATE:

The coarse aggregate particles passing through 20mm and retained on 12.5 mm I.S Sieve used as the natural aggregate which met the grading requirement of IS 383-1970.

iv)WATER:

Ordinary potable water

v)STEEL FIBER:

Crimped Steel Fiber were used.(Aspect ratio:20)

vi) CALCIUM SILICATE:

Calcium silicate a product is used as filling material, in this investigation. Calcium silicate purchased from astra chemicals, Chennai were used. The properties of calcium silicate were showed in Table 1

S.NO	Oxide composition	Calcium Silicate
1	SILICA (SiO2)	78. 5
2	CALCIUM (CaO)	19. 2%
3	CHLORIDES	TRACES
4	SULPHATE	TRACES
5	LEAD (Pb)	5
6	ARSENIC (As)	2

Table 1 : Properties of Calcium Silicate

III .MIX DESIGN

Mix design for control specimen (as per code IS10262-1982)

1)Target Strength

fck' = fck+1.65S

fck' = 38.25 N/mm^2

ii) Selection of w/c ratio

The free water cement ratio required for the target strength 38.25 N/mm2 is 0.38From figure 1 IS 10262-1982

Max w/c ratio = 0.38

iii) The selection of water and sand content:

For 20 mm nominal size of aggregate and sand confirming to grading zone II.

Water content per m3 of concrete = 186 kg.

Sand content as percentage of total aggregate by absolute volume =35%

Adjustment is made according to IS code.

Table 2 : Adjustment of values in water & Sand

DESCRIPTION	WATER CONTENT	% OF SAND
Zone – 2	0	0
IS 456 : 2000 (Pg. No :17) Compacting factor	3	0
Each 0.05 increase (or) decrease	0	-4.4
Total Adjustments	3	-4.4

Required sand content as percentage of total aggregate by absolute volume = 35 - 4.4

= 30.6%

Required water content = 186 + (186 × 3) / 100

= 191.58 l/m3

Determination of Cement content

Cement content = (191.58/0.38)

= 504.15 kg/m3

Determination of Fine and Coarse aggregate

FA = 488.64 kg/m^3

CA = 1148.8 kg/m^3

SPECIMEN	**CSF-1**	**CSF-2**	**CSF-3**	**CSF-4**
CEMENT	96%	93%	90%	87%
FINE AGGREGATE	100%	100%	100%	100%
COARSE AGGREGATE	100%	100%	100%	100%
CALCIUM SILICATE	3%	6%	9%	12%
STEEL FIBER	1%	1%	1%	1%
WATER RATIO	0.38	0.38	0.38	0.38

Table 2 : Mix Proportion

IV.RESULTS AND DISCUSSIONS

1.COMPRESSIVE STRENGTH TEST

S.No	Combination	Compressive strength of concrete N/mm^2	
		7 DAYS	28 DAYS
1	Control	20.8	31.11
2	CSF-1	21.8	32.66
3	CSF-2	21.11	30.8
4	CSF-3	17.3	28
5	CSF-4	15.3	24.44

Table.3 Compressive strength Test

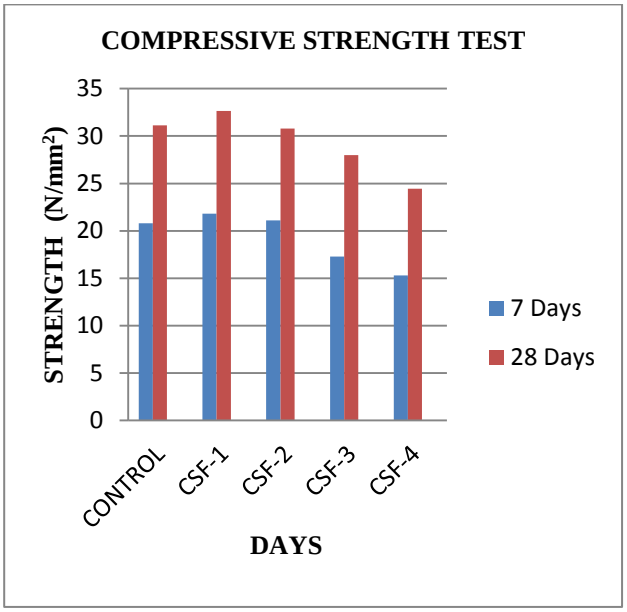

Fig: 1 COMPRESSIVE STRENGTH TEST

2.SPLIT TENSILE STRENGTH TEST

S.No	Combination	Split Tensile strength of concrete N/mm^2	
		7 DAYS	28 DAYS
1	Control	1.55	2.33
2	CSF-1	1.69	2.829
3	CSF-2	1.84	2.47
4	CSF-3	1.25	1.414
5	CSF-4	0.51	0.707

Table 4 Split Tensile strength Test

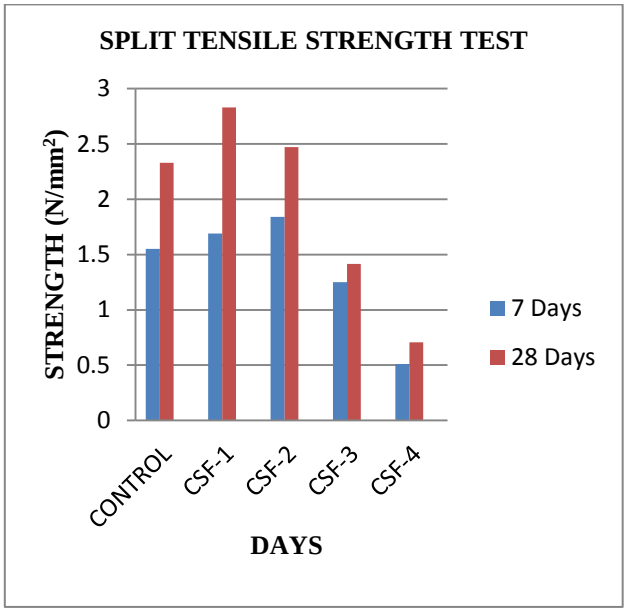

Fig 2 Split Tensile strength Test

3..RESIDUAL COMPRESSIVE STRENGTH TEST

S.no	Combination	Before heating	After heating (300ºC)	After heating (400ºC)	After heating (500ºC)
1	Control	9.90	3.30	5.5	3.2
2	CSF-1	9.65	4.52	4.57	3.96
3	CSF-2	9.57	2.82	3.82	2.98
4	CSF-3	7.65	1.69	2.26	1.02
5	CSF-4	6.75	0.8488	1.13	0

Table:5 Residual compressive strength test

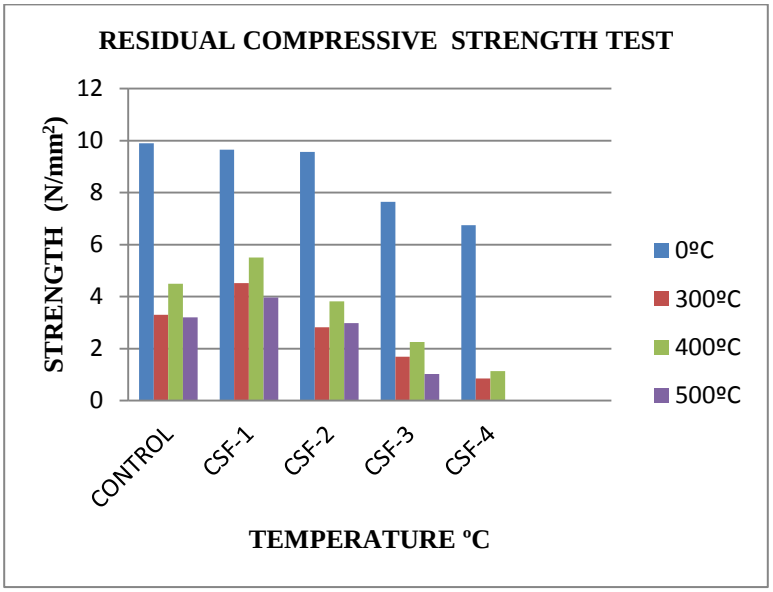

Fig.3 Residual compressive strength test

4.THERMAL CONDUCTIVITY TEST

Thermal conduction is the transfer of heat from one part of a body to another with which it is in contact. Thermal conductivity is defined as ability of material to transmit heat and it is measured in watts per square metre of surface area for a temperature gradient of 1 K per unit thickness of 1 m. The thermal conductivity is not always constant. The main factors affected the thermal conductivity are the density of material, moisture of material and ambient temperature. With increasing density ,moisture and temperature the thermal conductivity increases too.Important is inner structure of materials. Metals and other dense solid materials tend to have high levels of conductivity, whereas materials with very small amount of solid matter and large proportion of voids (gas or air bubbles, not large enough to carry heat by convection) have the lowest thermal conductivities

$T_r = T_w + Q/4K * r^2$ (Solid cyclinder)

$Q = V*I$

$T_r - T_w / T_o - T_w = {}_{1-} r^2$

where

T_w = Wall or surface top

T_r = Temperature at radius

T_o= Temperature at mid plane

r= Radius of specimen

q =Heat flow

S. no	Mix	Before heating 300ºC	After heating 300ºC	Before heating 400ºC	After heating 400ºC	Before heating 500ºC	After heating 500ºC
1	Control	2.161	2.048	2.378	2.270	2.478	2.347
2	CSF-1	2.306	2.184	2.394	2.259	2.238	2.178
3	CSF-2	2.084	1.981	2.070	1.965	2.308	2.298
4	CSF-3	2.011	1.904	2.237	2.126	2.222	2.169
5	CSF-4	1.932	1.799	2.175	2.063	2.096	1.965

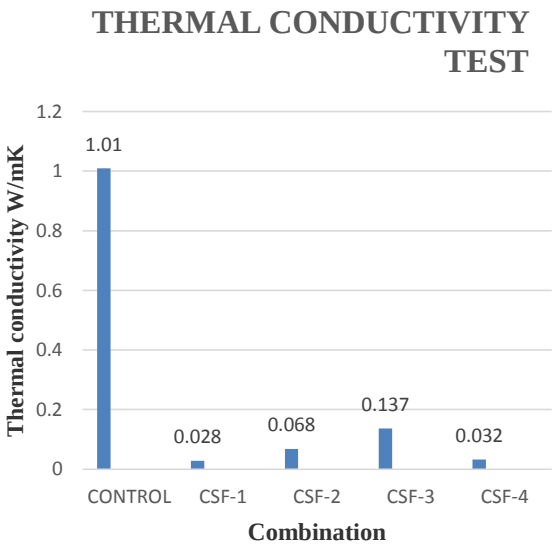

Fig: 4 THERMAL CONDUCTIVITY TEST

5.WATER ABSORPTION TEST

S.no	Combination	Dry weight	Wet weight	Percentage of water absorption
1	Control	8.787	8.889	1.16
2	CSF-1	8.677	8.767	1.037
3	CSF-2	8.520	8.671	1.77
4	CSF-3	8.269	8.467	2.394
5	CSF-4	8.004	8.289	3.56

Table:6 Water Absorption test

6.MASS LOSSES

The mass of concrete specimens was measured and the losses in mass were calculated and compared. There may be too many causes of loss in weight after high temperature exposure. However spalling or expulsions of chunks of material from the surface layers are principal causes of loss in weight

Table:7 Mass Losses

V.CONCLUSION

The following conclusions could be drawn from the present investigation.

- The Maximum values of compressive strength (32.66N/mm^2),Split tensile strength(2.829 N/mm^2), after 28 days with addition of 1% steel fiber and 3%calcium silicate in to the mix as compare with normal M30 grade concrete without any additives.
- All the specimen upto 500ºc did not show any sign of cracks.
- The residual compressive strength test result shows that there is a reduction in the compressive strength after heating the concrete at 500 ºc for 1hour
- The unit weight of the concrete decreased when it was exposed to elevated temperature. This finding is due to the release of bound water from the cement paste and the occurrence of air voids in the concrete.
- Generally thermal conductivity of concrete is 1.2-1.75 W/mK. But in this type of concrete reduce the thermal conductivity ,so it is better thermal property of concrete.
- Finally the test result indicate that addition of minimum percentage of calcium silicate increasing compressive strength as well as thermal resistant.

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Construction Project Time Management Aid of Software Application

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Abstract— *The main objective of the project is to do effective management in the time for the construction activities of an apartment building located at Sankarankovil near Tirunelveli. This study is to be managing the issues due to unexpected delays with very optimum time. The project management tool used is Microsoft Project 2013. Microsoft Project is used to do the planning, scheduling, resource allocation and costing for the construction activities in this project. The Gantt chart was drawn based on the sequence of activities in the construction site with the corresponding duration. After the listing of activities and allocation of resources, scheduling is done by both the methods i.e., manually and by using Microsoft Project software and they are compared. By using this software, scheduling of the building was resulted based on the control of duration.*

Keywords— effective management; delays; scheduling; Microsoft Project; Gantt chart; resource allocation; efficient;

I. INTRODUCTION

Project is a non-repetitive one-time venture to build something of lasting value, amidst formidable uncertainties to be overcome. It is a job that has a beginning and an end (time), a specified outcome (scope), at started level of quality (performance) and a budget (cost). Organization performs work. Project management is an art and science of mobilizing and managing people, material, equipment and money to complete the assign project of work on time within the budgeted cost and by specified technical performance standards. There is always a dynamics link between these thee forces. The key objective of the construction project management is to complete the project with the allotted time, resources and within the budgeted cost. Project gets starts at the right way but as it proceeds further, gets off the track. The project leads to some delays in the construction site which can be managed by additional resource allocations and appropriation of overtimes for the labours thereby resulting in the uncertainty of cost. Some of the delays that makes the MS Project estimation modified when compare to the manual estimation are shown.

a) Unexpected recess
b) Weather conditions
c) Labour Strike,
d) Changes made to the existing design etc..

A project is essentially a set of operations or activities to be completed in logical order. In project management, a schedule is a listing of a project's milestones, activities, and deliverables, usually with intended start and finish dates. . The schedule is a management tool used to predict project completion, and thereby ensure timely completion by adjusting resources applied to the work.

II LITERATURE REVIEW

A. Gulghane.A.A & Khandve. P.V(2015) explained that,

In recent treads a wide range of building materials is available for the construction of civil engineering structures. The total cost of materials may be up to 60% or more of the total cost incurred in construction project dependent upon the type of project. Effective construction materials management is a key to success for a construction project. Construction waste is another serious problem in construction industry. A large and various types of construction waste with different characteristics are created at all the stages of construction. Construction industries have a larger part in contributing environmental problems. One of the major problems in delaying construction projects is poor materials management. This paper presents a review on systematically investigation of the management of construction materials and construction waste,

material management techniques, control of construction waste and existing situation of construction management and construction waste in the industry.

B. ***Wale. P. M et al., (2015) conversed that,***

The project may have a simple goals that does not require many people or a great deal of money or it may be quite complex, calling for diverse skills and plethora of resources. But the bottom line is that every one of us manages projects. A project is a temporary aim designed to produce a special product, service or result with a defined starting and end (usually time-constrained, and often constrained by funding or deliverables), undertaken to meet eccentric goals and objectives, typically to bring about beneficial change or added value. Project gets started at the right way but as it proceeds further, gets off the track. The temporary nature of projects stands in contrast with business as usual (or operations), which are recurring, permanent, or semi-permanent functional activities to produce products or services.

III CONTROLING OF DELAYS

The cost can be affected mainly due to delays in the project due to various reasons. The causes for the delays can be indentified and are listed below.

Some of the delays are delay in submission of drawings, space constraints, and delay in payment by client, delay in material supply and local problems like strikes.

Delays in the project

In this construction project, the cost issues are due to unexpected holidays and shortage of resources. The unexpected holidays are listed below.

1. May Day
2. Pooja holidays
3. Deevali holidays
4. Chief Minister death
5. Demonetarization
6. Pongal holidays
7. New Year holidays

The calendar is set in the MS Project with considering the delays. The delays can be controlled by conferring the overtimes for the labours and also giving additional resources to complete the project within the scheduled time. The holidays are compensated by giving the overtime to the labours so that the scheduling can be controlled within the limited time without any delay to the customers. The overtime is given for the Sundays after the long delay due to the demonetarization. The problem with the material deficiencies are control by exchanging the activities having the enough materials and equipment.

The holidays that are not included in the manual scheduling are shown below as in the MS project.

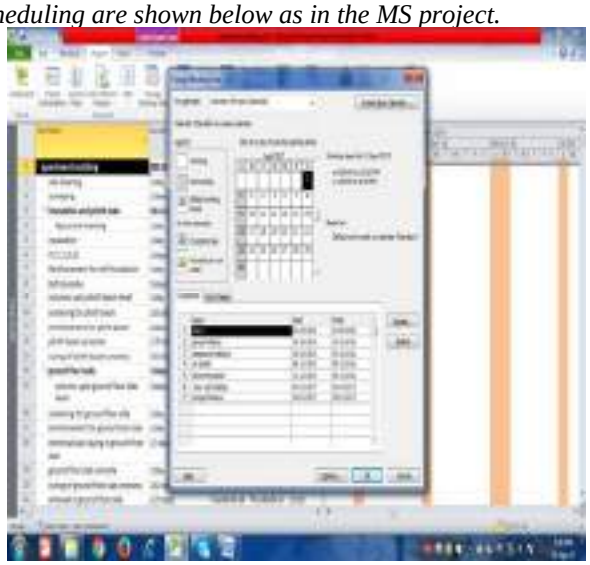

Fig. 1 Exceptions of working days

The overtime on the Sundays are shown below as in the Ms Project.

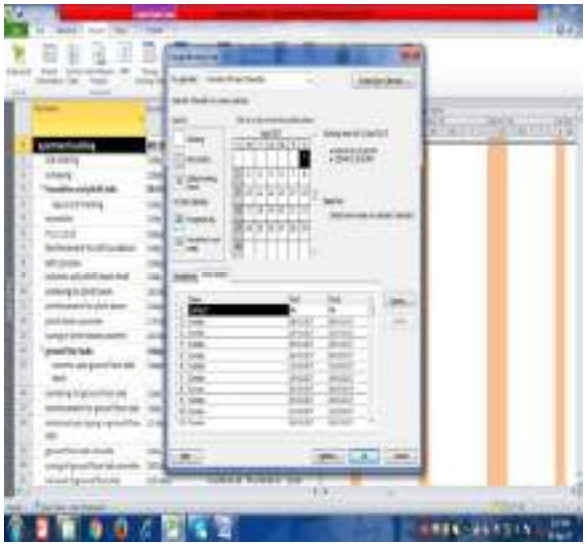

Fig. 2 Overtime days

In the overtime days like Sundays the same working is allotted (from 8 am to 5 pm). These overtime days requires additional resources to complete the project. So that the cost can be increase due to the rate increasing fo the additional resources and delay for the lobours who are present on the overtime days. The manual estimation is done by not considering the

unexpected delays. So the cost would be lower when compare to the MS Project estimation.

IV MANUAL SCHEDULING BEFORE TRACKING

The initial scheduling of our construction project is done using Microsoft Office Excel 2007. This is done by giving regular delays that causes issues in the future scheduling. The assumed problems that cause delays in the scheduling are holidays and weather conditions. The manual scheduling is replaced by the Microsoft Project scheduling that includes the actual delays that caused the issues in the construction site. The manual scheduling is shown below covering the activities and duration.

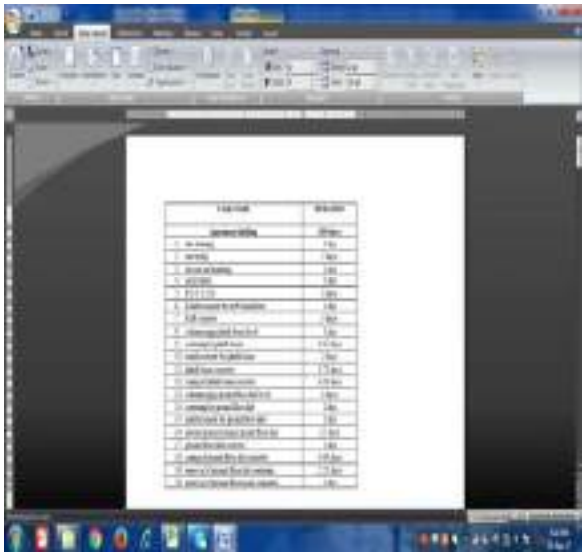

Fig. 3 Scheduling (contd.)

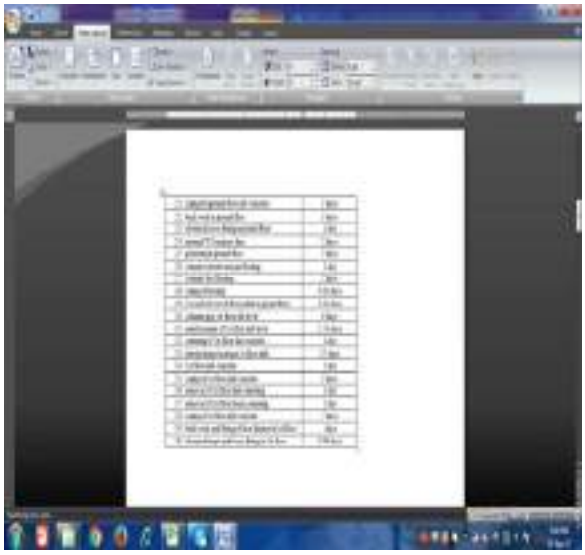

Fig. 4 Scheduling (contd.)

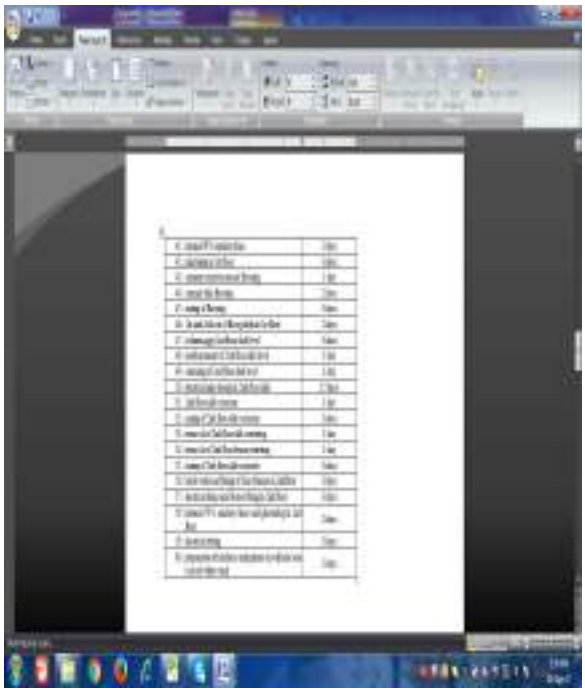

Fig. 5 Scheduling (contd.)

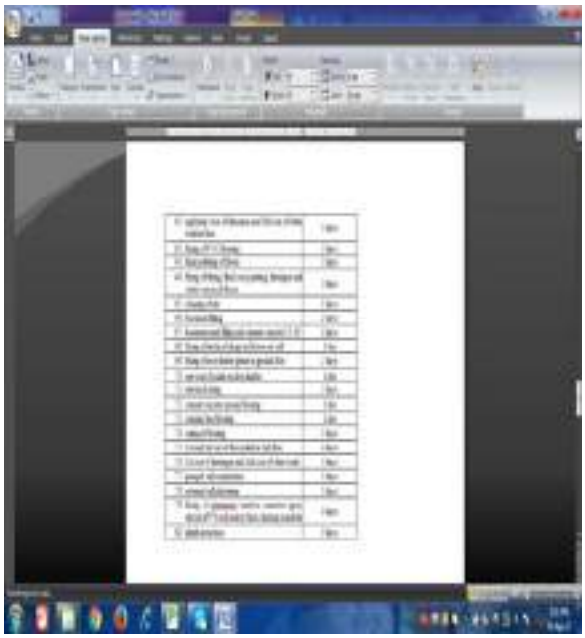

Fig. 6 Scheduling (contd.)

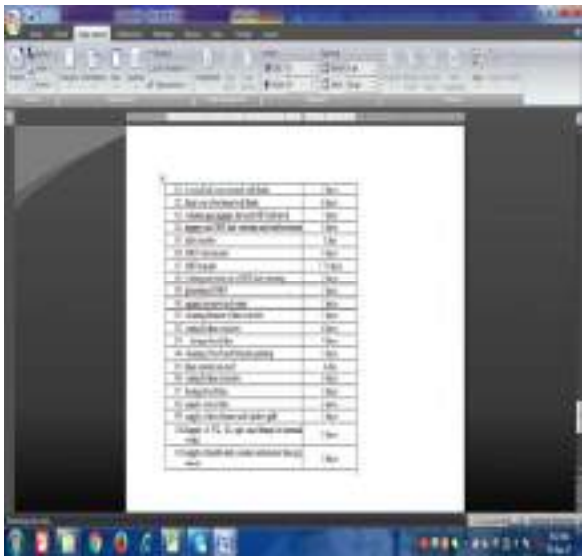

Fig.7 Scheduling (contd.)

VII. MICROSOFTT PROJECT SCHEDULING

In our project, we tracked the schedule which caused the delays in the construction at the site due to the unexpected holidays and other problems. The Gantt chart shows the scheduling for critical (red bars) and non critical activity (blue bars).

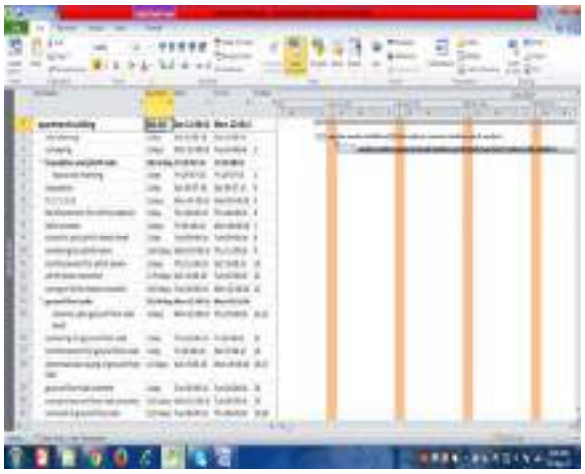

Fig.8 MSP Scheduling (at initial stage)

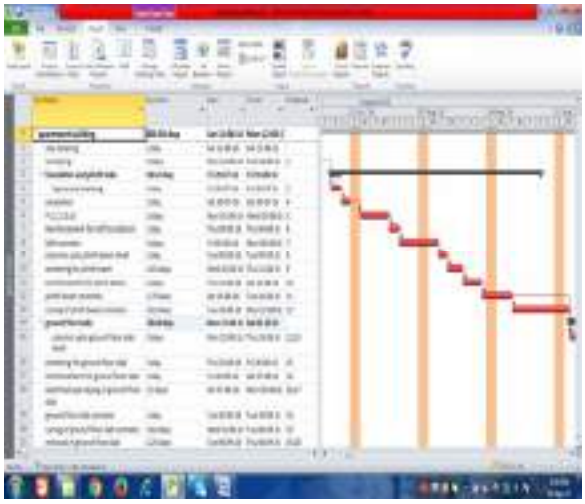

Fig.9 MSP Scheduling (critical path)

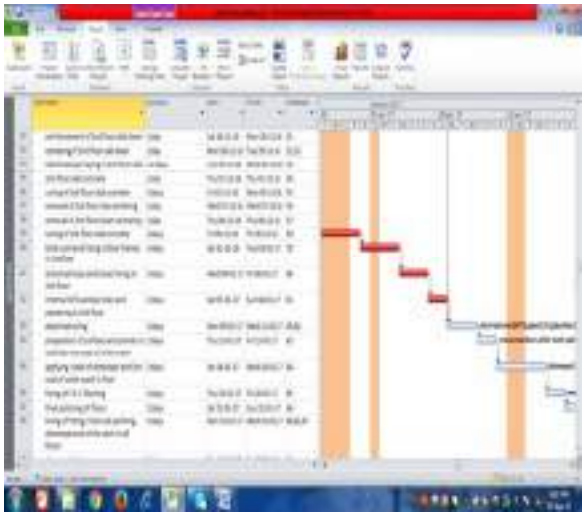

Fig.10 MSP Scheduling (critical and non critical path)

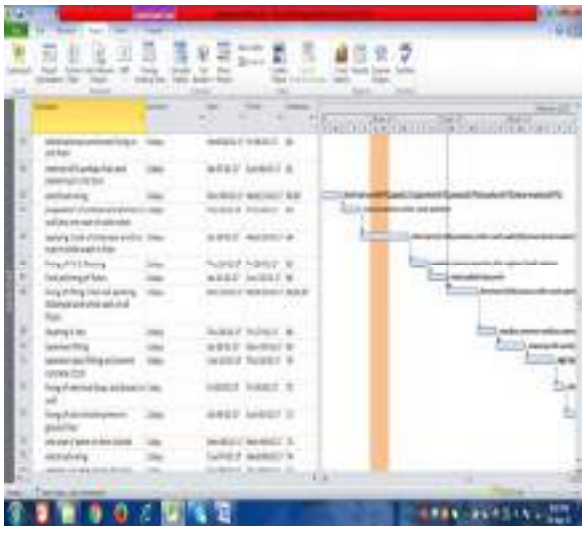

Fig.11 MSP Scheduling (non critical path)

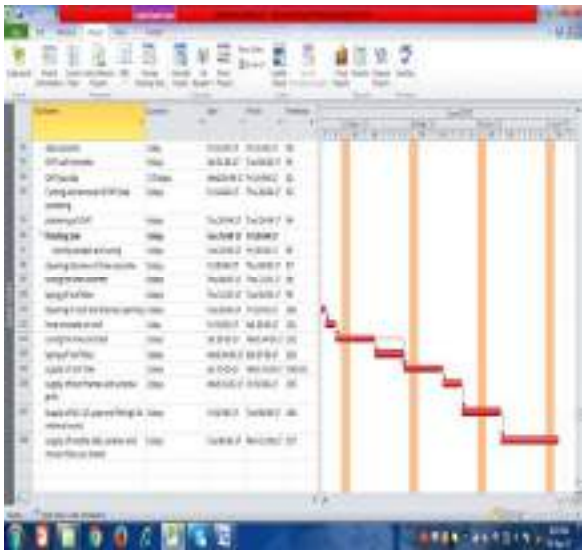

Fig.12 MSP Scheduling (at final stage)

VIII CONCLUTION

BASED ON BOTH THE METHODS (MANUAL AND MS PROJECT) OF SCEDULING, THE FOLLOWING CONCLUSIONS ARE ARRIVED.

This manual scheduling consists of time of the activity and the name of the activity to be performed. Activity represents its schedule of work. The start of the manual scheduling marks the commencement of the activity and the end of the completion. The manual scheduling shows that the project would be completed within 309 days. The time of the activity includes the weekly leave i.e. Sunday. Other unexpected leaves are not included in the manual scheduling. Here the scheduling is done by considering the unexpected holidays and the duration have been lowered by providing overtime and the project have been completed within the expected duration i.e. 303 days with some extra resources. The project is completed with both critical and non critical paths. The tracking of the project is done from 11.06.2016 to 30.03.2017. The remaining portion of the overheat tank are to be complete and these can also be tracked in this project. On this comparison between the manual and software methods of scheduling, it is concluded that "Computer Aided Scheduling" is most efficient and time saving one and also makes the project, cost effective with Proper Planning.

Acknowledgment

We sincerely thank **Dr.K.SUBARAMANIAN M.E.,Ph.D,** principal, for providing us the facilities that we need for the successful completion of our project.

We highly thank **Dr.M.SHAHUL HAMEED M.E., Ph.D., M.B.A., Ph.D**., Dean (Research)and Head of the Department of civil engineering for his guidance , encouragement and constant support.

We wish to thank our guide Mr. **S. ASHOK MANIKANDAN M.E** for abiding interest in fastening the steady progress of our project.

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STUDY ON FLEXURAL STRENGTH OF HIGH PERFOMANCE CONCRETE USING VARIOUS PROPOTIONS OF METAKAOLIN

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Abstract- Due to the growth of construction industry and major infrastructure project , there is a huge demand for cement as a building material and It also creates environmental problems ,some of them being increasing of CO2 and results emission of heat .Then there should be higher strength is to provided .The attempt has been made to compare, the 7days and 28 days compressive strength and Split tensile strength of concrete by using metakaolin with the normal concrete of M60 grade with maintaining water cement ratio.The objective of this study is to develop concrete with good strength.Thus the cement can be replaced by metakaolin which is artificial clay .That varying percentage of metakaolin is added as 5%,10%,15% to the concrete mixture in order to improve the performance of concrete. Blending these materials with ordinary Portland cement can improve the cementing and mechanical properties of cement .These days use of metakaolin is tremendously gaining popularity in partial replacement of cement due to its fineness in improving strength and parameters of mortars and concrete.

Keywords: Metakaolin,concrete, compressive strength and Split tensile strength.

1.INTRODUCTION

Concrete is basically a mixture of cement, fine and coarse aggregates. Concrete is an extraordinary and key structural material in human history. Concrete holds the credit of being the most widely utilized tailored or man-made material in the construction industry and will hold good for the years to come. High performance concrete is a concrete mixture, which possess high durability and high strength when compared to conventional concrete. This concrete contains one or more of cementious materials such as fly ash, Silica fume or ground granulated blast furnace slag and usually a super plasticizer. The term 'high performance' is somewhat pretentious because the essential feature of this concrete is that it's ingredients and proportions are specifically chosen so as to have particularly appropriate properties for the expected use of the structure such as high strength and low permeability. Metakaolin is a dehydroxylated form of the clay mineral kaolinite . stone that are rich in kaolinite are known as china clay or kaolin , tradionally used in the manufacture of porcelain.Considered to have twice the reactivity of most other pozzolans , metakaolin is a valuable admixture for concrete cement applications. Considered to have twice the reactivity of most other pozzolans , metakaolin is a valuable admixture for concrete cement applications . Replacing Portland cement with 8-20% (by weight) metakaolin produces a concrete mix , which exhibits favourbale engineering properties , including the filler effect , the acceleration of OPC hydration ,and the pozzolanic reaction occurs between 3and 14days

2.METHODS AND MATERIAL PROPERTIES

2.1Methodology:

Mix design of M60 concrete was done with various propotions of metakaolin. The curing was done for 7and 28 days , after the hardened tests of compressive ,flexural and tensile were made on specimen for the strength test**.**

2.2MATERIAL PROPERTIES

2.2.1Metakaolin

Metakaolin is a dehydroxylated form of the clay mineral kaolinite . stone that are rich in kaolinite are known as china clay or kaolin , tradionally used in the manufacture of porcelain. The particle size of metakaolin is smaller than of cement particles ,but not as fine as silica fume

The quality and reactivity of metakaolin is strongly dependent of the characteristics of the raw material used . Metakaolin can be produced from a variety of primary and secondary sources containing kaolinite

The T-O clay mineral kaolinite does not contain interlayer water. The temperature of dehydroxylation depends on the structural layer stacking order. Disordered kaolinite dehydroxylates between 530 and 570º , ordered kaolinite between 570 and 630ºC . Dehydroxylated disordered kaolinite shows higher pozzolanic activity than ordered

The adsorption surface properties of the metakaolins can be accomplished by inverse gas chromatography analysis

Considered to have twice the reactivity of most other pozzolans , metakaolin is a valuable admixture for concrete cement applications . Replacing Portland cement with 8-20% (by weight) metakaolin produces a concrete mix , which exhibits favourbale engineering properties , including the filler effect , the acceleration of OPC hydration ,and the pozzolanic reaction occurs between 3and 14days

Chemical composition	Metakaolin (%)
Silica (Sio_2)	54.3
Alumina (Al_2o_3)	38.3
Ferric oxide(Fe2o3)	4.28
Calcium oxide(Cao)	0.39
Magnesium oxide(Mgo)	0.08
Sodium oxide(Na_2o)	0.12
Potassium oxide(K_2o)	0.50
Sulphuric anhydride(So_3)	0.22
Loss on ignition(LOI)	0.68
Blaine (m^2/kg)	150000
Specific gravity	2.5

3.LITERATURE SURVEY

An extensive review was carried out to study the design of high performance concrete with metakaolin . The review also focuses on the strength and durability aspects of using HPC. Though there are a number of research papers available or lower grade of concrete using metakaoine only a limited number of publication are available on the HPC using metakaolin and structural behavior of reinforced concrete. The literatures pertaining to this topic are given below in brief

Prof. R.M. Sawant, Dr. Y.M. Ghugal-Volume - 4,Issue-12,pp- 08-14[1].Due to worldwide infrastructural development, since 20th century use of concrete has tremendously increased which resulted in heavy manufacturing of cement. Various types of pozzolonic materials viz.fly ash, silica fume, metakaolin, blast furnace slag etc. are available which has cementeous properties.Blending these materials with ordinary portland cement can improve the cementing and mechanical properties of cement.It can be concluded that the partial replacement of cement by metakaolin has a good influence on the strengths of the cement mortars and concrete. It increases strengths of all basic properties viz. compressive strengths, flexure strengths, split strengths, tensile strengths etc.

B. B. Patil, P. D. Kumbhar Volume-3 Issue-4 2009 March[2] Strength and Durability Properties of high performance concrete incorporating High Reactivity Metakaolin.Concrete is probably the most extensively used construction material in the world. The addition of mineral admixture in cement has dramatically increased along with the development of concrete industry, due to the consideration of cost saving, energy saving, environmental protection and conservation of resources. Mineral admixtures such as fly ash, rice husk ash, metakaolin, silica fume etc are more commonly used in the development of HPC mixes. The results of the study indicate that the workability and strength properties of HPC mixes improved by incorporating HRM up to a desirable content of 7.5% by weight of cement.

P.Dinakar,Pradosh K.Sahoo and G. Sriram Volume -4 Issue-2 2011[3] Effect of metakaolin content on the Properties of High Strength Concrete This study presents the effect of incorporating metakaolin (MK) on the mechanical and durability properties of high strength concrete for a constant water/binder ratio of 0.3.MKmixtures with cement replacement of 5, 10 and 15 %were designed for target strength and slump of 90 MPa and 100 ± 25 mm. From the results, it was observed that 10 % replacement level was the optimum level in terms of compressive strength. From the results, it was observed that 10 % replacement level was the optimum level in terms of compressive strength.The results shows that by utilizing local MK and cement designed for a low water/binder ratio of 0.3, high strength and high performance concretes can be developed and compressive strengths of more than 100MPa can be realized.

SanjayN.Patil1,AnilK.Gupta,SubhashS.DeshpandeVolume3,Issue7July2015[4]Metakaolin-pozzolanic material for cement in high strength concrete. The infrastructure development is an important aspect for the overall development of country. India is developing as a major hub for service industry, automobile industry and for which the infrastructure development plays an important role. The necessity of high strength concrete is increasing because of demands in the construction industry.

Shaikh Mohd Zubair1, S.S. Jamkar -2015 August[[5]Now a day's high performance concrete is

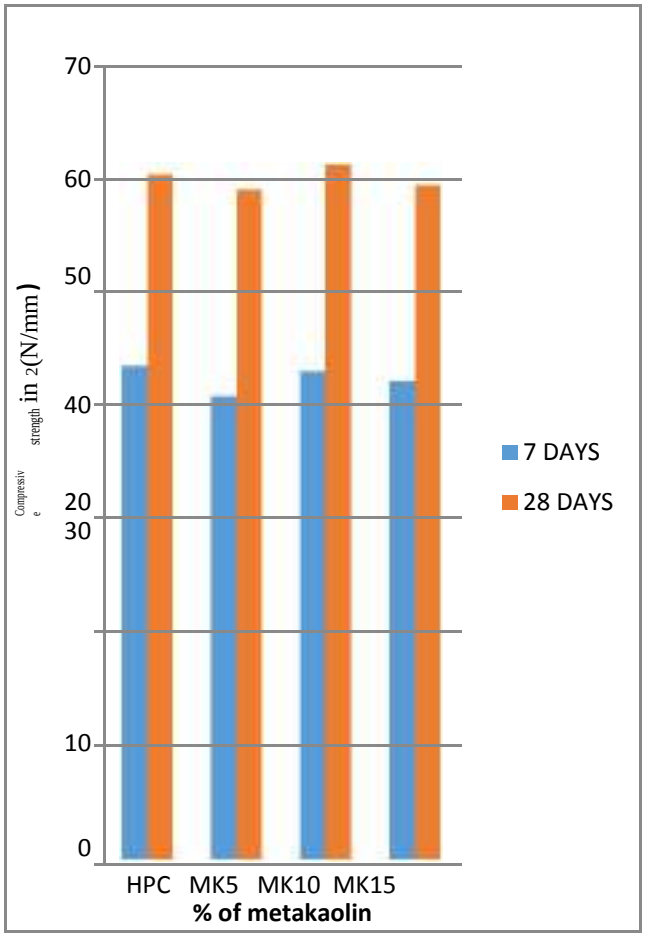
globally used in the infrastructure industry for strong and durable structure, to produced high performance concrete various supplementary cementitious material are used as mineral admixture. This research involves the use of Fly ash, Alccofine and Silica fume at various proportions to enhance the compressive strength of high performance concrete. the investigation was carried out by replacing 10% fly ash along with 17% of alccofine and 10% fly ash along with 17% of silica fume by weight of cementitious material. To cover a wide range of compressive strength of concrete various water binder ratio (W/b) of 0.25, 0.3 and 0.35 were used. The effect of various parameters such as percentage replacement of mineral admixture, water to binder ratio and corresponding compressive strength is studied on fresh and hardened state of concrete. The study mainly consisted of establishing relation between these parameters graphically. Investigation demonstrates that alcofine performs batter than that of silica fume along with fly ash in fresh and harden state

SudarsanaRao.Hunchate1,Sashidhar.Chandupalle2,Vaishali.G.Ghorpode3 and Venkata Reddy.T.C4 - 3, March 2014[6]High Performance Concrete (HPC) now a days used widely in the construction industry world wide. To produce HPC with normal ingradients we use mineral admixtures like Silica fume, fly ash and metakoline and workable agents Superplasticizers are also used. The usage of mineral admixtures in the concrete not only enhances its strength properties but also durability. The compressive strength are investigating finding the optimum use of mineral admixture(Silica fume of levels 0, 5, 10,15, 20 and 25% at 7 days and 28 days.

4.RESULT AND DISCUSSION

After testing the properties of fresh concrete mix on HPC, concrete cubes,cylinders, prisms were cast for studying the properties of hardened concrete .The following tests were carried out on hardened concrete of various HPC

S.NO	MIX	7Days	28Days
1	HPC	4.72	5.16
2	MK5	4.56	5.43
3	MK10	4.81	5.71
4	MK15	4.63	5.56



4.1Graphical representation of Flexural strength

S.NO	MIX	7Days	28Days
1	HPC	3.53	4.52
2	MK5	3.11	4.2
3	MK10	3.39	4.81
4	MK15	3.25	4.67

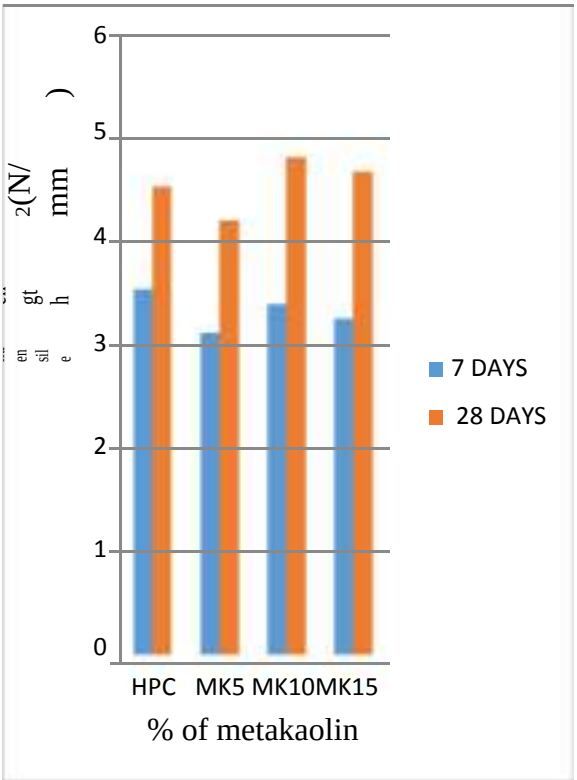


FIG: 4.2 Split tensile strength

5.CONCLUSION

- It can be concluded that the partial replacement of cement by metakaolin has a good influence on the strength of the cement mortar.
- The mineral morpology of both cement and metakaolin being identical contributes as a better binding material.
- It can be derived by use of 8%to 12% metakaolin by weight of cement with metakaolin from 1to 3% by weight cement.
- Cement replacement upto 10% with metakaolin leads to increase in compressive strength ,splitting tensile strength for both M60 grade
- There is a decrease in workability as the replacement level increase and water consumption was more for higher replacement.
- Use of metakaolin gives significant result on properties of concrete as compared to normal concrete.

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Planning,Scheduling and Tracking of Residential Building Using Project Management Software

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Abstract—*Planning and scheduling is very important in construction project. Proper planning, scheduling and tracking are the major parameter in construction industry. The systematic flow of work is adopted by using Critical Path Method and Programme Evaluation and Review Technique. Without proper controlling and scheduling will cause cost overrun and consequently increases project duration. In order to minimize the complexity in manual calculation Project Management Software can be preferred. Oracle Primavera P6 is one of the best software in construction management.*

Keywords-Scheduling,Tracking,CPM,PERT,Project Management Software,Planning,Primavera P6.

I. INTRODUCTION

Project is an activity to meet the creation of **unique product** or service and thus activities are undertaken to accomplish routine activities cannot be considered as project. Construction industry is an integral component of a nation's infrastructure and industrial growth. Even though Construction management. Many issues are being faced by construction industry that must be taken care of. They include time and cost overruns due to inadequate project formulation, poor planning for implementation, lack of proper contract planning and management and lack of proper management during execution. It has been estimated by analysts that average cost of a project goes up by 30 percentage compared to the budgeted cost. Observations show that proper skillful management is imperative for the timely completion of the project within estimated budget and with allocated resources. Projects with good planning, adequate organizational machinery and sufficient flow of resources cannot automatically achieve the desired result. There must be some warning mechanism, which can alert the organization about its possible success and failures, off and on. Industry is the second largest industry in India, the growth of this industry has been differential across the nation. The rural regions need tools for economic development, land use and environment planning to cope with the status of development in urban areas. The time available to achieve this goal is shrinking. Here arises the need for effective project

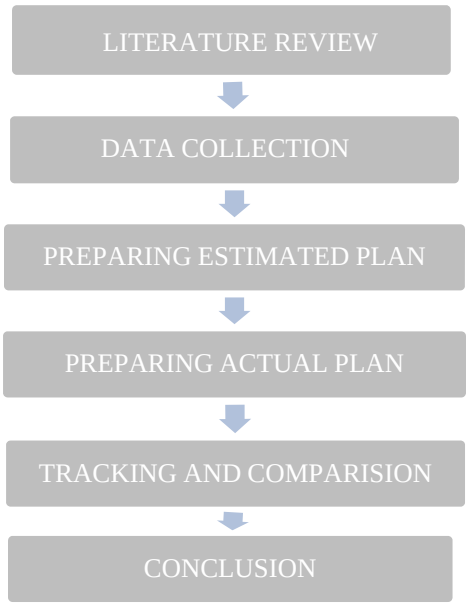

Fig 1 Methodology

II. OBJECTIVES

The objectives of this study are:

- To identify construction sequence for a residential building construction.
- To work out the practical durations required to carry out the activities.
- To identify scheduling technique used by the organization on developing plan and scheduling.
- To develop scheduling using primavera project planner's software.
- To track the project and analyses the reasons for delays, and increase in estimated budget etc.
- To investigate defects in the planning and scheduling procedure of the organization, and suggest suitable improvements in their methods.

III. RESEARCH METHODOLOGY

A.LITERATURE REVIEW

Subramani.T and Chinnadurai.K (2015) has discussed that long-introduced Industrialized Building System (IBS) has promised to solve and improve the current construction method and scenario in our country, but the IBS method has not gained enough popularity. One of the reasons is due to lack of research works done to quantifying the benefit of IBS especially in construction time saving. In lieu with such scenario, this study conducted to quantify evidence of time saving in IBS application. Primavera P6 is amazing software, which is used not just by planners, but also managers, engineers, schedulers, and anyone else involved in planning, management, reporting of a project.. Designed to make managing large or complex projects a piece of cake, Primavera is the ideal tool for anyone who is involved in planning, Monitoring and reporting on the progress of any big task, development or venture. Primavera allows for top level planning as well as being ideal for managing the intricate details. This enables project managers, planners, planning controllers and other associated professionals to have instant access to all the project information they require at the touch of a button. Also from this study shown not all IBS components can improved to the overall construction duration, however by adopting IBS components can improve and expedite the construction of 18 stories residential building from the point of departure of the project throughout of the whole of project‘s with a total 405 days or 42% the time saving.

Andrew Fernans Tom and Sachin Paul (2013) have proposed that project monitoring and control is the process of collecting, recording, and reporting information concerning project performance. Project controlling uses the data from monitor activity to bring actual performance to planned performance. The present study deals with the project monitoring process of “Standard Design Factory”; a four storied (G+3) factory building whose construction is in progress at Cochin, Kerala. A comparison between the planned progress of construction work and actual progress is performed in this study using project management software Primavera P6. Despite well-established principles and policies of project monitoring the process itself may not be efficiently accomplished in a project, because of those practical problems existing or arising in the project Such an attempt in realizing the practical problems in implementation of project monitoring and control will contribute to proper recognition of the problem areas and putting in place the control process to rectify the deviations.

Sandip Pawar and Attarde.P.M (2013) has described that planning and scheduling using tools and devices are helpful in comparing the project with stipulated cost, time and quality. Resequencing model proposed to overcome the delay factor from the critical area, to minimize that delay of the construction and to reduce the time, cost and it also helpful to concentrate on the major areas in the project. It has hands-on experience in an ongoing project, and evaluation of schedule of equipment, staff, labour and material. It helps to plan and evaluate the resources for the construction of the building project. It also compares the cost variation due to the delay of the project and rescheduling the project by crashing process.

Boskee Sharma and Labh.K.N (2012) has illustrated that construction project shall employ the latest and the best available project planning and management package.Primavera project management, one of the most sought after software package employed by a large group of industries, world over. The project planning and management aims to ensure the project deliverables are completed and delivered in time, within the stipulated cost, and meets the stakeholder’s requirements and expectations. It also adopts methods, control processes in monitoring and implementation to reduce as best as possible any changes of failure at some stage or another. The planning process for a building construction with some alternative schemes such as execution schedule, activities relationship, resource allocation etc. has been attempted to examine the consequence of overall implementation in terms of scope, time and cost to the project.

Dayakar.T and Udhayakumar.M (2012) has described that implementation of construction project needs a proper planning and scheduling is of vital importance for the project to be executed and run smoothly. A best schedule has to be prepared in such a way that meets the primary objectives of the total project. That primary objective is to create a quality project, completed on time, within budget, and in a safe work environment. Hence in this study an ongoing construction project is taken and the execution of the project is compared with the schedule with the help of Microsoft Project. An ongoing project in IIT Madras is selected and the activities pertaining to the Substructure is considered for comparison. From the study, it is found, how the project is planned, the sequence of work and linking relationships between activities for the whole project. In conclusion it is understood that, it is important to realize that there will be changes to the schedule logic as well as differences between the planned progress and actual progress. Based on the differences the schedule needs to be changed so as to complete the project smoothly.

B.DATA COLLECTION:

The data which is required for the schedule of the project was collected from the site. The total number of activities that are required for the schedule are listed out. The construction is for a residential purpose having G+5 and the carpet area of the construction is 57000 Sqft.

C.PREPARING ESTIMATED PLAN:

The estimated schedule preparation process the site,the plan and estimation report were collected from AAD ARCHITECH Chennai.

Activity ID	Successors	Activity Name	Predecess	Original Duration
A45	A49, A48, A46	POURING CONCRETE FOR LINTEL&SUNSHADE	A44, A43	4
A46	A47	REMOAVL 0F SHUTTERING FOR LINTEL&SUNSHADE	A45	3
A47	A48	CURING FOR LINTEL&SUNSHADE	A46	2
A48	A50	BRICK WORK UPTO ROOF	A45, A47	7
A49	A51	BAR BENDING FOR ROOF&STAIRCASE	A45	7
A50	A51	CENTRING FOR ROOF&STAIRCASE	A48	3
A51	A52, A53, A63	POURING CONCRETE FOR ROOF&STAIRCASE	A50, A49	6
+1FLOOR				74
A52	A64	CURING FOR ROOF&STAIRCASE	A51	3
A53	A54, A94	REMOVAL 0F CENTRING FOR ROOF&STAIRCSAE	A51	4
A54	A58, A57, A62	FITTIRNG DOOR&WINDOWSG.F	A53	7
A55	A88, A87	PLASTERIBNG INSIDE G.F	A58, A57	20
A57	A55	ELECTRICAL FITTING	A54	7
A58	A55	PLUMBING WORK G.L	A54	8
A63	A65	BAR BENDING FOR COLUMN&LIFT	A51	4
A64	A65	SHUTTERING FOR COLUMN&LIFT UPTO1.5m	A52	3
A65	A66, A68	POURING CONCRETE FOR COUMN&LIFT 1.5m	A63, A64	4
A66	A67	REMOVAL 0F SHUTTERING FOR COLUMN&LIFT 1.5m	A65	3
A67	A68	CURING FOR COLUMN&LIFT 1.5m	A66	3
A68	A69	SHUTTERING FOR COLUMN&LIFT UPTO ROOF	A67, A65	3
A69	A73, A72, A70	POURING CONCRETE FOR COLUMN&LIFT	A68	4
A70	A71	REMOVAL SHUTTERING FOR COLUMN&LIFT	A69	3
A71	A72	CURING FOR COLUMN&LIFT	A70	3
A72	A74	BRICK WORK UPTO LINTEL	A69, A71	7
A73	A75	BAR BENDING FORLINTEL&SUNSHADE	A69	4
A74	A75	SHUTTERING FOR LINTEL&SUNSHADE	A72	3
A75	A76, A79, A78	POURING CONCRETE FOR LINTEL&SUNSHADE	A73, A74	3
A76	A77	REMOVAL 0F SHUTTERING FOR LINTEL&SUNSHADE	A75	3

Fig 2 Activity List upto 1st floor

Activity ID	Successors	Activity Name	Predecess	Original Duration
A139	A141	BAR BENDING FOR ROOF&STAIRCSAE		2
A140	A141	CENTRING FOR ROOF&STAIRCASE		4
A141	A153, A142	POURING CONCRETE FOR ROOF&STAIRCASE	A139, A14	2
A142	A154, A143	CURING FOR ROOF&STAIRCASE	A141	2
A153	A155	BAR BENDING FOR COLUMN&LIFT	A141	2
A154	A155	SHUTTERING FOR COLUMN&LIFT	A142	4
A155	A158, A156	POURING CONCRETE FOR COLUMN&LIFT	A153, A15	2
A156	A157	REMOVAL 0F SHUTTERING FOR COLUMN&LIFT	A155	3
A157	A158	CURING FOR COLUMN&LIFT	A156	2
A158	A159	SHUTTERING FOR COLUMN&LIFT	A155, A15	4
A159	A160, A162	POURING CONCRETE FOR COLUMN*LIFT	A158	2
+5FLOOR				369
A143	A144	REMOVAL CENTRING FOR ROOF&SUNSHADE	A89, A142	3
A144	A152	FITTING DOOR&WINDOW	A143	6
A145	A151	PLASTERING INSIDE 3FLOOR	A148, A14	10
A147	A145	ELECTRICAL FITTING 3FLOOR	A152	7
A148	A145	PLUMBING WORK 3FLOOR	A152	10
A152	A147, A148	BRICK WORK IN STAIRCASE 3FLOOR	A144	15
A160	A161	REMOVAL 0F SHUTTERING FOR COLUMN&LIFT	A159	3
A161	A162	CURING FOR COLUMN&LIFT	A160	2
A162	A164	BRICK WORK UPTO LINTEL	A161, A15	10
A163	A165	BAR BENDING FOR COLUMN&LIFT		2
A164	A165	SHUTTERING FOR LINNTEL&SUNSHADE	A162	4
A165	A166, A168	POURING CONCRETE FOR FOR LINTEL&SUN	A164, A16	2
A166	A167	REMOVAL OF SHUTTERING FOR LINTEL	A165	3
A167	A168	CURING FOR LINTEL&SUNSHADE	A166	2
A168	A170	BRICK WORK UPTO 4FLOOR	A167, A16	15
A169	A171	BAR BENDING FOR ROOF&STAIRCASE		2

Fig 3 Activity List upto 5th floor

D.PREPARING ACTUAL PLAN:

Actual schedule preparation process starts with collection of the data like project start date, activities involved in the construction of a G+6 apartment with activities sequence, duration taken for each activities, resources needed for each and every activities and its amount, cost spent for each and every activities. The collected data are entered in the software and the relation between the activities is given as per its sequence of activities collected. The process of scheduling in primavera for the actual progress of work and the report obtained for the actual schedule from the primavera software are prepared. This actual schedule and report is considered as a schedule for this project.

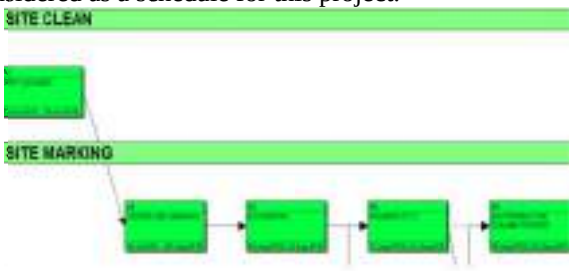

Fig 4 Work Break Down Structure

Scheduling is the process of organizing the activities and assigning its duration to complete the works in time.

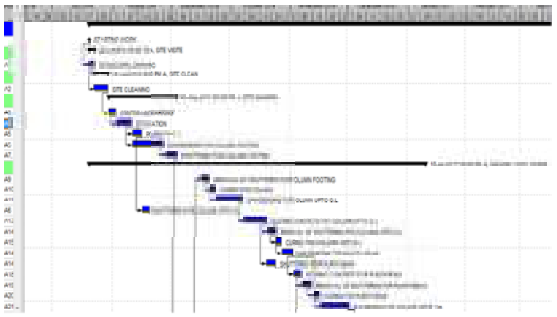

Fig 5 schedule upto 1st floor

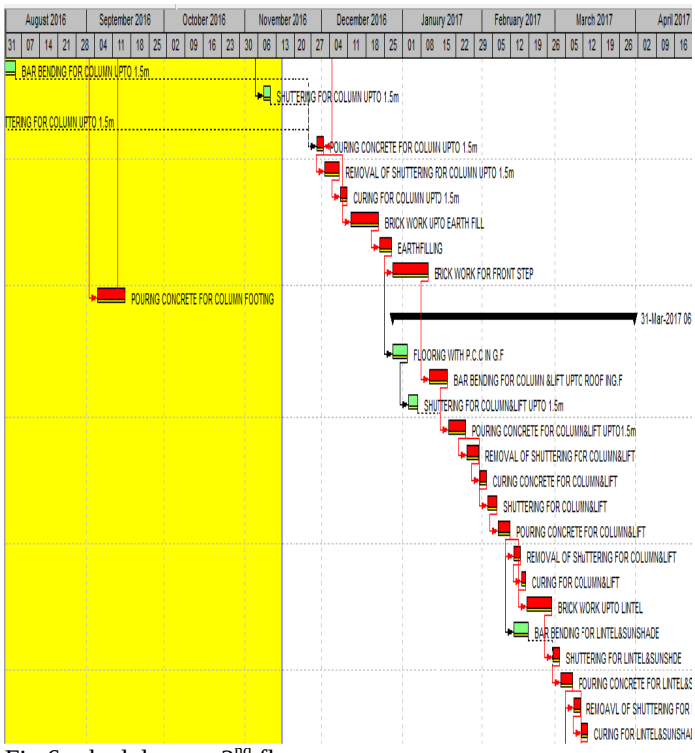

Fig 6 schedule upto 2nd floor

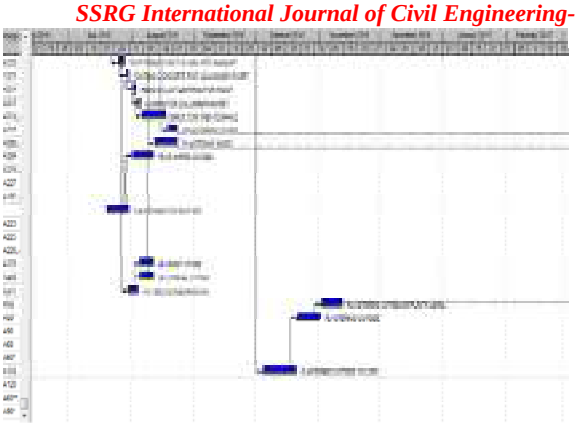

Fig 7 schedule upto 4th floor

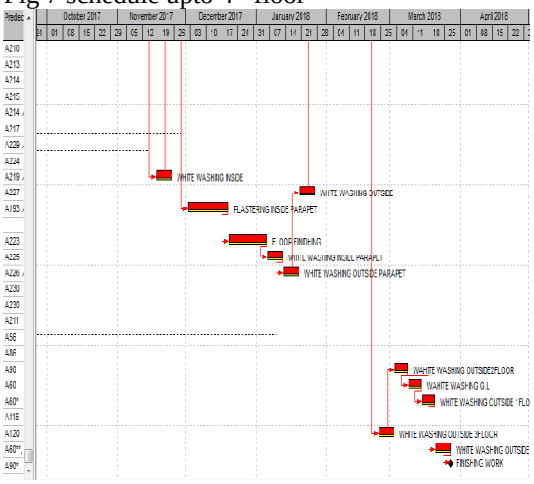

Fig 8 schedule upto 4th floor

E.TRACKING AND COMPARISION:

The schedule that was prepared was tracked and updated from November 1st to March 31th and actual costs are calculated based on the updated schedule. Record actual start date for those activities which started. Record activity % complete for the ongoing or completed activities to determine how much of the work has been completed. In this project tracking for upto 4th floor.The actual scheduling upto 4th floor is 392 days. In primavera scheduling duration upto 4th floor is 417. The delay of the project is 25 days. The reason for the delay of the project is demonization issue of financial problem, delay in material supply, various issues in respective states, banking restriction.

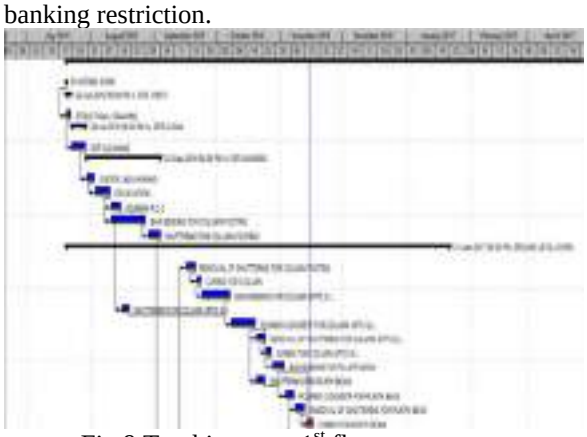

Fig 9 Tracking upto 1st floor

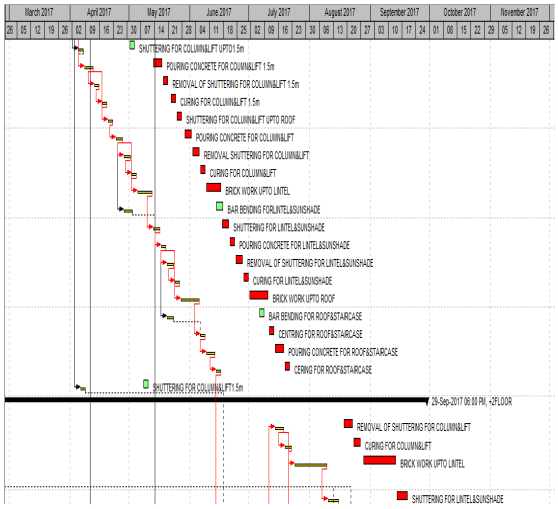

Fig 10 Tracking upto 3rd floor

Fig 11 Tracking upto 4th floor

IV. RESULT AND DISCUSSION

TABLE 1 RESULTS

S.NO	DESCRIPTION	DAYS
1	Manual Scheduling	693
2	Primavera Scheduling	683
3	Scheduling up to 4th floor	392
4	Tracking up to 4th floor	417

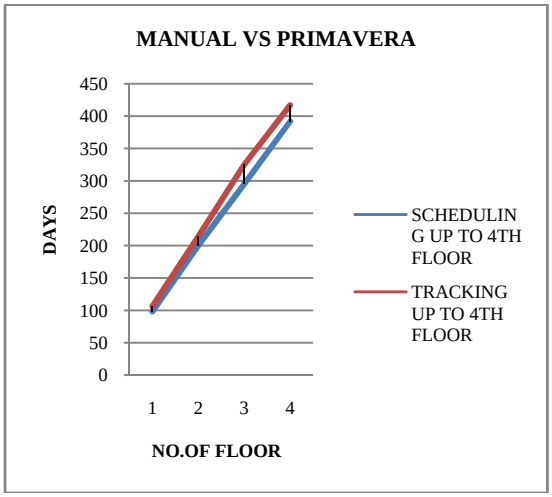

Fig 12 Actual Vs Planned

V. CONCLUSION

Based on the comparison between the manual scheduling and primavera scheduling, Primavera is efficient for scheduling the project and also to optimize the days by using Primavera. The critical path scheduling is done by using Primavera. The standard norms of the building had refered from QUANTITY SURVEYING BOOKS & PUBLIC WORKS DEPARTMENT. Primavera is efficient for the project because linking the project activities easily and also by using the four relationships can optimize the time of project. The shouldn't have any modification in critical path. The delay of the construction project is due to improper planning and scheduling. Thus this project concludes that the delay can be rectified by proper scheduling and periodical tracking throughout the project.

Acknowledgment

We sincerely thank **Dr.K.SUBARAMANIAN M.E., Ph.D.,** principal, for providing us the facilities that we need for the successful completion of our project.

We highly thank **Dr.M.SHAHUL HAMEED M.E.,Ph.D.,M.B.A.,Ph.D**.,Dean (Research) and Head of the Department of civil engineering for his guidance, encouragement and constant support.

We wish to thank our guide Mr. **S. ASHOK MANIKANDAN M.E** for abiding interest in fastening the steady progress of our project.

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Construction Scheduling Using Project Management Software

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Abstract**—***Planning and scheduling is very important in construction project. Proper planning, scheduling and tracking are the major parameter in construction industry. The systematic flow of work is adopted by using Critical Path Method and Programme Evaluation and Review Technique. Without proper controlling and scheduling will cause cost overrun and consequently increases project duration. In order to minimize the complexity in manual calculation Project Management Software can be preferred. Oracle Primavera P6 is one of the best software in construction management.*

Keywords—Planning,Scheduling,CPM,PERT,Project Management Software,Primavera P6.

I. INTRODUCTION

Project is an activity to meet the creation of **unique product** or service and thus activities are undertaken to accomplish routine activities cannot be considered as project. The completion time for a unique endeavor can vary from a few hours to many years, and the cost can change from low to very high. Each project has a specified mission or a purpose to be achieved. It ceases after the mission is accomplished. A construction project mission is to create desired facilities like a housing complex or a fertilizer plant with predetermined performance objectives defined in terms of quality specification, completion time, budgeted costs and other specified constraints. Project management is the discipline of initiating, planning, executing, controlling, and closing the work of a team to achieve specific goals and meet specific success criteria. A project is a temporary endeavor designed to produce a unique product, service or result with a defined beginning and end undertaken to meet unique goals and objectives, typically to bring about beneficial change or added value. Construction planning is a fundamental and challenging activity in management and execution of construction projects. It includes the selection of technology, the definition of work task, the estimation of required duration and resources of individual task, and identify the interactions between different work tasks. A good construction plan is the base for developing the schedule and the budget for work. Primavera is the most effective tool for construction management. Primavera is the industry leading project and program management solution for projects any size. Primavera enables to manage time, tasks, costs, resources, contracts, change and risks to consistently execute profitable projects

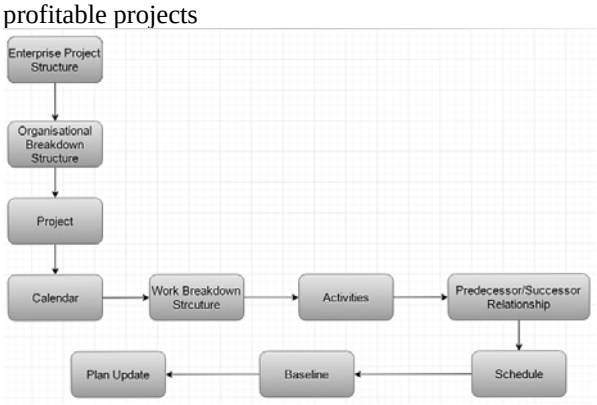

Fig 1 Execution Plan

II. OBJECTIVES

The objectives of this study are:

- To identify construction sequence for a residential building construction.
- To work out the practical durations required to carry out the activities.
- To identify scheduling technique used by the organization on developing plan and scheduling.
- To develop scheduling using primavera project planner's software.
- To track the project and analyses the reasons for delays, and increase in estimated budget etc.
- To investigate defects in the planning and scheduling procedure of the organization, and suggest suitable improvements in their methods.

III. EXPERIMENTAL WORK

A.LITERATURE REVIEW

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in our country, but the IBS method has not gained enough popularity. One of the reasons is due to lack of research works done to quantifying the benefit of IBS especially in construction time saving. In lieu with such scenario, this study conducted to quantify evidence of time saving in IBS application. Primavera P6 is amazing software, which is used not just by planners, but also managers, engineers, schedulers, and anyone else involved in planning, management, reporting of a project.. Designed to make managing large or complex projects a piece of cake, Primavera is the ideal tool for anyone who is involved in planning, Monitoring and reporting on the progress of any big task, development or venture. Primavera allows for top level planning as well as being ideal for managing the intricate details. This enables project managers, planners, planning controllers and other associated professionals to have instant access to all the project information they require at the touch of a button. Also from this study shown not all IBS components can improved to the overall construction duration, however by adopting IBS components can improve and expedite the construction of 18 stories residential building from the point of departure of the project throughout of the whole of project‘s with a total 405 days or 42% the time saving.

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B.RESEARCH WORK

Organizational Breakdown Structures is an hierarchical arrangement of an organizational management structures. OBS is defined at a global level and relates and relates with EPS to control user access to project information.OBSrelates every single unit of the project.

Fig 2 Organizational Breakdown Structures

Calendars are used to set the project ant its resources workining times to accurately reflects availabilty of resources.

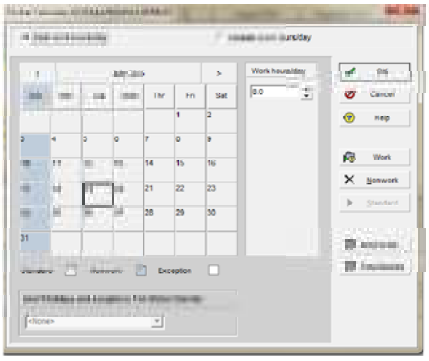

Fig 3 Calendar

Activities are fundamental work element of project.

Activity ID	Successors	Activity Name	Predecess	Original Duration
A45	A49, A48, A46	POURING CONCRETE FOR LINTEL&SUNSHADE	A44, A43	4
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A48	A50	BRICK WORK UPTO ROOF	A45, A47	7
A49	A51	BAR BENDING FOR ROOF&STAIRCASE	A45	7
A50	A51	CENTRING FOR ROOF&STAIRCASE	A48	3
A51	A52, A53, A63	POURING CONCRETE FOR ROOF&STAIRCASE	A50, A49	6
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A53	A54, A94	REMOVAL OF CENTRING FOR ROOF&STAIRCSAE	A51	4
A54	A58, A57, A62	FITTIRNG DOOR&WINDOWSG.F	A53	7
A55	A88, A87	PLASTERIENG INSIDE G.F	A58, A57	20
A57	A55	ELECTRICAL FITTING	A54	7
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A64	A65	SHUTTERING FOR COLUMN&LIFT UPT01.5m	A52	3
A65	A66, A68	POURING CONCRETE FOR COUMN&LIFT 1.5m	A63, A64	4
A66	A67	REMOVAL OF SHUTTERING FOR COLUMN&LIFT 1.5m	A65	3
A67	A68	CURING FOR COLUMN&LIFT 1.5m	A66	3
A68	A69	SHUTTERING FOR COLUMN&LIFT UPT0 ROOF	A67, A65	3
A69	A73, A72, A70	POURING CONCRETE FOR COLUMN&LFT	A68	4
A70	A71	REMOVAL SHUTTERING FOR COLUMN&LIFT	A69	3
A71	A72	CURING FOR COLUMN&LIFT	A70	3
A72	A74	BRICK WORK UPTO LINTEL	A69, A71	7
A73	A75	BAR BENDING FORLINTEL&SUNSHADE	A69	4
A74	A75	SHUTTERING FOR LINTEL&SUNSHADE	A72	3
A75	A76, A79, A78	POURING CONCRETE FOR LINTEL&SUNSHADE	A73, A74	3
A76	A77	REMOVAL OF SHUTTERING FOR LINTEL&SUNSHADE	A75	3

Fig 4 Activity List upto 3rd Floor

Activity ID	Successors	Activity Name	Predecess	Original Duration
A139	A141	BAR BENDING FOR ROOF&STAIRCSAE		2
A140	A141	CENTRING FOR ROOF&STAIRCASE		4
A141	A153, A142	POURING CONCRETE FOR ROOF&STAIRCASE	A139, A14	2
A142	A154, A143	CURING FOR ROOF&STAIRCASE	A141	2
A153	A155	BAR BENDING FOR COLUMN&LIFT	A141	2
A154	A155	SHUTTERING FOR COLUMN&LIFT	A142	4
A155	A158, A156	POURING CONCRETE FOR COLUMN&LIFT	A153, A15	2
A156	A157	REMOVAL OF SHUTTERING FOR COLUMN&LIFT	A155	3
A157	A158	CURING FOR COLUMN&LIFT	A156	2
A158	A159	SHUTTERING FOR COLUMN&LIFT	A155, A15	4
A159	A160, A162	POURING CONCRETE FOR COLUMN*LIFT	A158	2
+5FLOOR				369
A143	A144	REMOVAL CENTRING FOR ROOF&SUNSHADE	A89, A142	3
A144	A152	FITTING DOOR&WINDOW	A143	6
A145	A151	PLASTERING INSIDE 3FLOOR	A148, A14	10
A147	A145	ELECTRICAL FITTING 3FLOOR	A152	7
A148	A145	PLUMBING WORK 3FLOOR	A152	10
A152	A147, A148	BRICK WORK IN STAIRCASE 3FLOOR	A144	15
A160	A161	REMOVAL OF SHUTTERING FOR COLUMN&LIFT	A159	3
A161	A162	CURING FOR COLUMN&LIFT	A160	2
A162	A164	BRICK WORK UPTO LINTEL	A161, A15	10
A163	A165	BAR BENDING FOR COLUMN&LIFT		2
A164	A165	SHUTTERING FOR LINNTEL&SUNSHADE	A162	4
A165	A166, A168	POURING CONCRETE FOR FOR LINTEL&SUN	A164, A16	2
A166	A167	REMOVAL OF SHUTTERING FOR LINTEL	A165	3
A167	A168	CURING FOR LINTEL&SUNSHADE	A166	2
A168	A170	BRICK WORK UPTO 4FLOOR	A167, A16	15
A169	A171	BAR BENDING FOR ROOF&STAIRCASE		2

Fig 5 Activities List above 3rd Floor

RESOURCE ALLOCATION is the process of assigning the machine, material and man power used in the project.

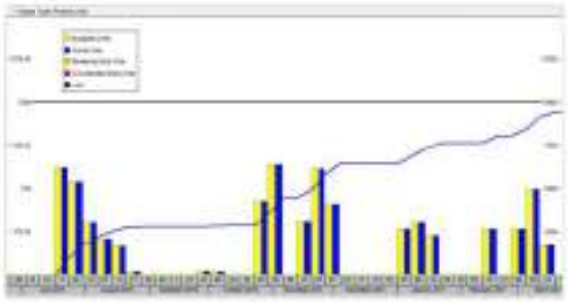

Fig 6 Resource Allocation

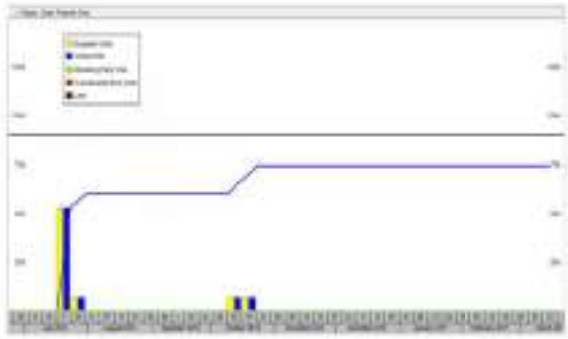

Fig 7 Machinery Allocation

Work Breakdown Structure is used to define and organize the project elements so as to clearly identify deliverables, reports, summarize schedule and cost data of the work. It is very essential in all the complicated problems.

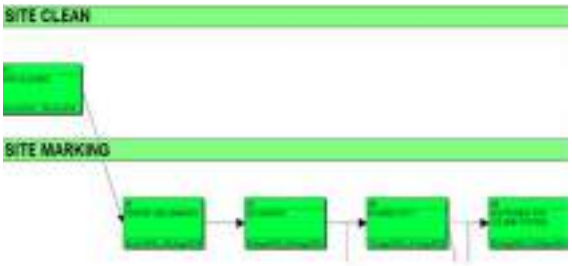

Fig 8 Work Break Down Structure

Scheduling is the process of organizing the activities and assigning its duration to complete the works in time.

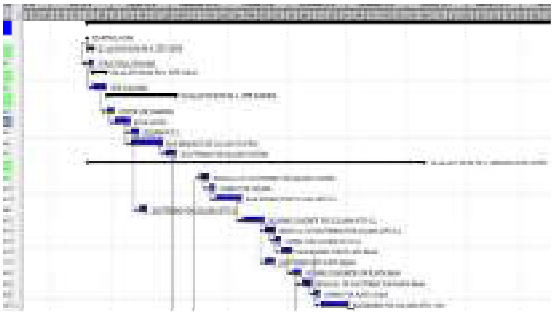

Fig 9 Scheduling of 1st Floor

Fig 10 Scheduling upto 3rd Floor

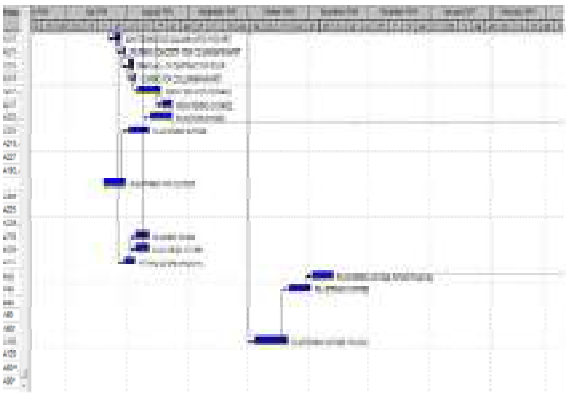

Fig 11 Scheduling upto 5th Floor

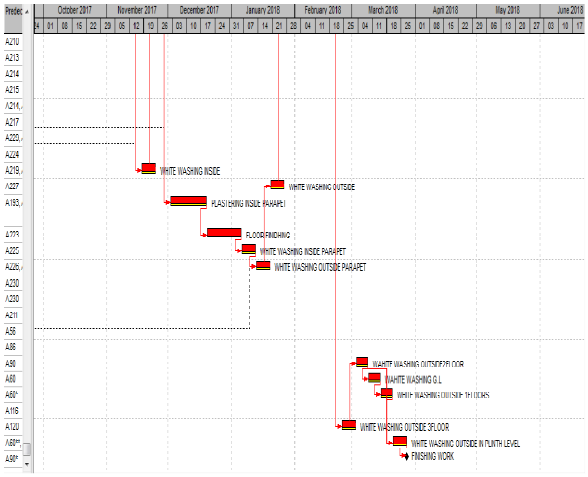

Fig 12 Scheduling upto 6th Floor

IV. Result And Discusion

TABLE 1 Scheduled Data

S.NO	DESCRIPTION	DAYS
1	Manual Scheduling	693
2	Primavera Scheduling	683

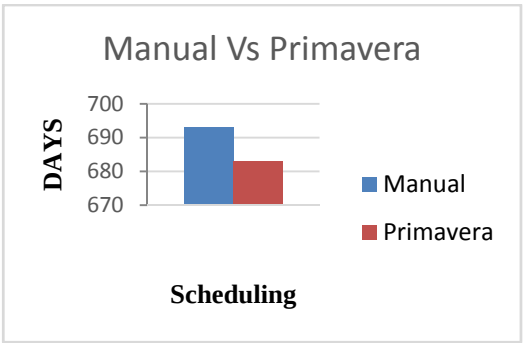

Fig 9 Result Comparision

Comparison

- In manual method more efforts should be taken while assigning resources, but in primavera fewer efforts are required.
- In manual method much confusion are arrived due to dependent activity but in primavera the dependent activity are identified easily.

V. CONCLUSION

Based on the comparison between the manual scheduling and primavera scheduling, Primavera is efficient for scheduling the project and also to optimize the days by using Primavera. The critical path scheduling is done by using Primavera. The standard norms of the building had referred from QUANTITY SURVEYING BOOKS & PUBLIC WORKS DEPARTMENT.

Primavera is efficient for the project because linking the project activities easily and also by using the four relationships can optimize the time of project. The shouldn't have any modification in critical path.

The delay of the construction project is due to improper planning and scheduling. Thus this project concludes that the delay can be rectified by proper scheduling and periodical tracking throughout the project.

Acknowledgment

We sincerely thank**Dr.K.SUBARAMANIAN M.E., Ph.D.,** principal, for providing us the facilities that we need for the successful completion of our project.

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We wish to thank our guide Mr. **S. ASHOK MANIKANDAN M.E** for abiding interest in fastening the steady progress of our project.

a.

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TOUGHNESS OF GEOPOLYMER FERROCEMENT TROUGH PANEL – AN EXPERIMENTAL STUDY

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Abstract— **This paper deals with the study of impact resistance and energy absorption properties of Geopolymer Ferrocement Trough Panel under impact load. Geopolymer is an eco-friendly binding material alternative for Ordinary Portland Cement (OPC). In the last decade fly ash based geopolymer has emerged as a promising new cement alternative in the field of building and construction materials. Ferrocement is a thin composite made with a fly ash based mortar matrix reinforced with closely spaced layers of relatively small diameter wire mesh. Over the years, applications involving Ferrocement have increased due to its properties such as strength, toughness, water tightness, lightness, ductility and environmental stability. This project aims to study and compare the structural behaviour of Ferrocement trough panel and its mechanical properties. These panels were subjected to impact loading by drop weight test method. It is concluded that Geopolymer Ferrocement Trough Panels with 10M NaOH solution using higher impact energy absorption capacity as compared other geopolymer mixes.**

Keywords— ***Ferrocement, Geopolymer, Wire mesh, Impact load.***

I. INTRODUCTION

The capability to absorb energy, often called 'toughness', is of importance in actual service conditions of mesh reinforced composites, when they may be subjected to static, dynamic and fatigue loads. Toughness evaluated under impact loads is the impact strength. Impact resistance of any reinforced composite can be measured by using a number of different test methods, which can be broadly grouped into the following categories.

a) Drop weight single or repeated impact test,

b) Constant strain rate test

c) Weighted pendulum charpy type impact test,

d) Explosion- impact test,

e) Projectile impact test,

f) Instrumented pendulum impact test,

g) Split Hopkinson bar test.

Several methods have been reported to evaluate the impact characteristics of concrete/cement composites. Of these, the simplest and most widely used test is the drop-weight test, which can be used to evaluate the relative performance of composites. Reported work on the impact behavior of Ferrocement slabs relates to the use of conventional reinforcement (chicken mesh and M.S. skeletal) and drop-weight method (instrumented/ordinary falling weight). Hence, in the present study drop-weight method was selected and used to study the impact characteristics of slab specimens. Ferrocement has been used for various offshore and marine structures, roofing, water tanks, grain silos and biogas plants. Even though conventional Ferrocement using ordinary cement mortar as matrix satisfies most general requirements, Ferrocement products which have higher ultimate moment and toughness are required for some special applications in ocean engineering and the chemical industry. Portland cement is the most common type of cement used in construction applications, but it is an expensive binder due to the high cost of production associated with the high energy requirements of the manufacturing process itself. The contribution of ordinary Portland cement production worldwide to greenhouse gas emission is approximately 7% of the total greenhouse gas emission to the atmosphere. The production of 1 ton ordinary Portland cement consumes 4GJ energy and produces about 1 ton of carbon dioxide (Co_2) to the atmosphere. About half of the Co_2 emissions from Portland cement production are due to calcination of limestone, while the other half are due to combustion of fossil fuel for the above reasons, recent research works are focusing on the feasibility of replacing cement with different types of waste products. Fly ash has gained prominence as the most commonly used waste material for partially replacing cement. A promising research outcome developed in the last decade is low calcium fly ash based geopolymer cement and concrete. Geopolymers

prepared by using the low calcium fly ash exhibit high compressive strength, low creep, minimal drying shrinkage, good acid resistance, fire resistance. The authors have conducted impact test to study the properties of geopolymer Ferrocement prepared with 10 molarity (M) geopolymer mortar which show excellent properties compared with the ordinary cement mortar.

II. LITERATURE REVIEW

In the experimental work carried out by **S. Nagan and R.Mohana (2014)[1]**, they found the resistance of geopolymer mortar slabs under impact load by dropping a steel ball from a considerable height. For this study, they used specimens of size 230 x 230 x 25 mm with different combinations of chicken mesh and rectangular weld mesh and are subjected to impact load by drop weight test and the impact energy required for first crack and final crack were calculated. They found that the combination of chicken mesh and rectangular weld mesh together showed better performance in case of energy absorption and residual impact strength. The compressive strength, flexural strength and split tensile strength of 10M geopolymer mortar specimens are found to be 36.05%, 33% and 27.7% more when compared to cement mortar specimens respectively. Also with increase in volume of reinforcement, energy absorption of geopolymer ferrocement specimen increases compared to cement mortar specimen.

In this experimental investigation **P.Saranyabanu (2014)[2],** The geometry of ferrocement panel is trough shape with dimensions of 1000 mm x 350 mm x 30 mm. For the panels with single wire mesh, the mesh was placed at mid depth of the panel and the mortar mix was prepared using sand-cement ratio and water-cement ratio by weight of 1:1 and 0.3, respectively. After 24 hours from casting, the samples are removed from the mould and the cured in water for 28 days. The flexural behavior of trough shaped ferrocement panels reinforced with skeletal steel and wire mesh with varying number of wire mesh layers is presented. The slab panels are tested under flexural loading by applying line loads at 1/3rd points. The cracking load was not significantly affected by the number of the wire mesh layer particularly for the Trough panel. From the experimental result, the flexural strength of the trough shaped panel with single layer wire mesh is 81% more than flat panel and 50% lower than folded panel. And the deflection is 61.18% less than flat panel and 44.68% more than folded panel. And trough shape panel with double layer wire mesh is 77.95 % more than flat panel and 53.81% lower than folded panel. And the deflection is reduced by 56.36% and 6.17% respectively when compared of flat panel and folded panel. Finally increasing the number of layers of wire mesh from 1 to 2 layers, significantly increase the ductility and capability to absorb energy of both types of the panel.

III. RESEARCH SIGNIFICANCE

In this investigation, the experiments were conducted to understand the structural behavior of Geopolymer Ferrocement Trough Panels under impact loading. The tests were mainly focused on the impact load test of geopolymer Ferrocement Trough Panels with all the four edges in fixed condition by drop weight test. This paper presents the no. of blows required for first crack stage, ultimate stage, impact load and energy absorption at first crack and ultimate stage.

IV. MATERIALS

a. Fly Ash

Fly ash is the most abundantly used mineral admixture as replacement for cement in mortar. It is also the main ingredient for geopolymer mortar due to its active participation in the geopolymerization process. Pozzolanic material exhibits cementitious properties when combined with calcium hydroxide. Fly ash is used as the pozzolana in many concrete applications. Fly ash is used as cement replacement.

b. Fine Aggregate

Locally obtained trichy river sand is used as the fine aggregate in the mortar mixes. The sieve analysis result indicates that the sand confirms to zone-II as per IS: 383- 1970.

c. Sodium Hydroxide

Generally, NaOH is available in market in pellets or flakes form with 96% to 98% purity where the cost of the product depends on the purity of the material. The solution of NaOH was formed by dissolving it in water based on the molarity required. It is recommended that the NaOH solution should be made 24 hours before casting and should be used with 36 hours of mixing the pellets with water as after that it is converted to semi-solid state.

d. Sodium Silicate

It is also known as water-glass which is available in the market in gel form. The ratio of SiO_2 and Na_2O in sodium silicate gel highly affects the strength of geopolymer mortar. Mainly it is seen that a ratio ranging from 1 to 1.5 gives a satisfactory result.

e. Wire Mesh

Steel wire meshes are considered as primary reinforcement. This include square woven or welded meshes, chicken (hexagonal/aviary) wire mesh, etc. Except for expanded metal mesh, generally all the meshes are used galvanized. Galvanizes chicken wire mesh with a hexagonal opening of size 12 mm and wire thickness of 1.29 mm was used in this study.

V. MIX PROPORTION AND EXPERIMENTAL INVESTIGATION

a. Geopolymer Mix Design

Sodium hydroxide concentration	= 10 M
Na_2SiO_3 to NaOH ratio	= 1:1.50
Fly ash to Sand ratio	= 1:1
Alkaline activator to Fly ash ratio	= 0.45
Curing type	= oven curing
Curing period (oven)	= 24 hrs@72°c -75°c

b. Preparation of Alkaline Activator Solution

The mixture of Na_2SiO_3 solution and NaOH solution can be used as the alkaline liquid. The Alkali activator solution has to be prepared before 24 hours of use because at the time of mixing Na_2SiO_3 and NaOH solution it generates a huge amount of heat and the polymerization takes place by reacting with one another, which will act as a binder in the geopolymer mortar. It should be used within 36 hours of mixing the pellets with water as after that it is converted to semi-solid state. The Sodium hydroxide, available in small flakes, is dissolved in water at different proportions as required molarity of solution.

c. Geometry of mould

Geometry shape of Ferrocement trough panel will be casted using geopolymer mortar and the size of panels. The tested ferrocement panels consist of two Trough panels. The dimensions of the trough are shown in Fig. (1) which depicts that the horizontal projection of the trough panel is (350x200mm) dimensions. The thickness of the panels is 30mm.The panels are constructed using the conventional ferrocement materials, which is composed of cement mortar and Galvanizes chicken wire mesh with a hexagonal opening.

Figure 1. Dimensions of the Trough panel

d. Casting of geopolymer ferrocement panels

Special mould was fabricated in metal sheet to match the required geometry of the trough panel. Each sample is molded after fixing the required wire mesh and skeletal steel in its proper position. For the panels with single wire mesh top of the skeletal steel. Then the panels were cast in sodium hydroxide concentration 10M, sodium hydroxide to sodium silicate ratio 1:1.50, fly ash to sand ratio of 1:1 and alkaline activator to fly ash ratio of 0.45 with proper compaction**.** The moulds were coated initially with oil so as to enable easy removal of the moulds. The moulds were placed on an even surface. The surface was painted with waste oil. Cover blocks were used to ensure a clear cover of 5 mm. Normal mild steel bars steel bars (nominal diameters 6 mm) were used as the reinforcing material. The steel reinforcement mat with required spacing was placed inside the moulds.

e. Impact machine set-up

Geopolymer Ferrocement trough panels were tested under drop weight impact load the impact was conducted using 4.5 kg hammer that was allowed to fall freely from a constant height of 460mm through a guide at the center of the panel for all the specimens with the simple support conditions as per ASTMD 2794.Specimens were placed in their position. The mass was then dropped repeatedly and the number of blows required to cause first crack was recorded. The number of blows required for failure was also recorded. For each panels the number of blows required to cause the first crack was noted. Then the process was continued further, till the crack propagated further and appeared at the top surface of the specimen. At the point, corresponding number of blows were noted. The no. of impact blows required to develop first visible crack was used to calculate the first crack impact strength. The schematic diagram of impact test experimental setup is shown in Figure 2.

Figure 2. impact machine set-up

VI.RESULTS AND DISCUSSION

a. Energy absorption

The mass was then dropped repeatedly and the number of blows required to cause first crack was recorded. Then the number of blows required for the failure is also recorded. Then the process was continued further, till the crack propagated further and appeared at the sides of the specimen. The number of blows required to cause the crack width of 2mm were also noted down. The total energy absorbed by the Ferrocement panels when struck by a hard impactor depends on the local energy absorbed both in contact zone and by the impactor. The energy absorption can be obtained by using the following formula.

$$E = N \times (w \times h) \text{ joules}$$

Where,

E= energy in joules
w= weight in Newton
h= drop height in meter
N= blows in numbers

The ratio of energy absorbed up to the failure of specimens to the energy absorbed at initiation of first crack is defined as the 'Residual Impact Strength Ratio' (Irs). The energy absorption capacities of Ferrocement slab specimens at first crack and at ultimate failure stages are presented.

Table 1 Impact Resistance of Geopolymer Ferrocement Trough Panels

S. No.	Specimens ID	First Crack Resistance – FCR (No. of blows)	Ultimate Resistance – UR (No. of blows)	Percent increase in Resistance from FCR to UR
1	GFP TH 01	8	22	1.75
	GFP TH 02	9	25	1.74

Table 2 Impact Energy of Geopolymer Ferrocement Trough Panels

S. No	Specimens ID	Impact Energy Absorbed (Joules)		Impact Strength Ratio (I_{rs})
		At First Crack	At Ultimate	
1	GFP TH 01	165.60	455.40	2.75
	GFP TH 02	186.30	517.50	278

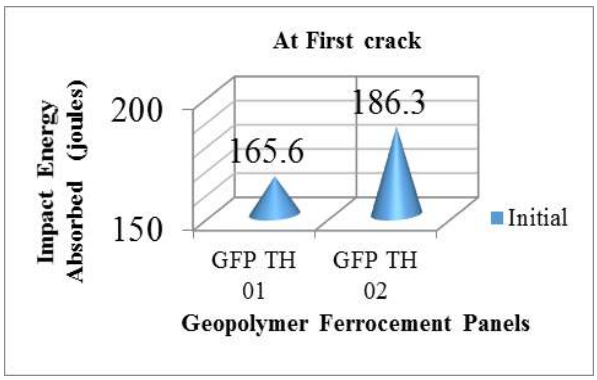

Figure 3 At first crack

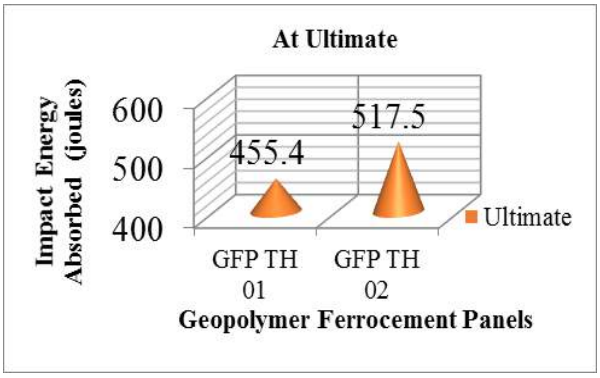

Figure .4 At Ultimate

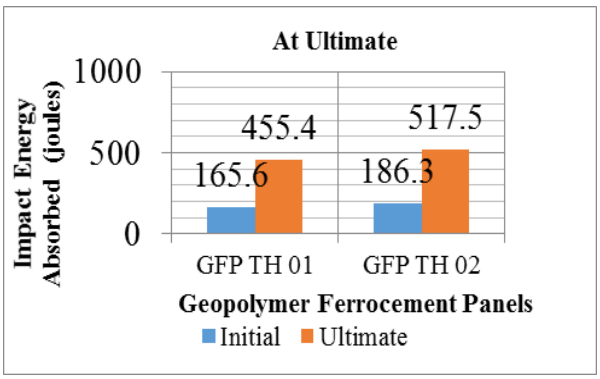

Figure 5. Impact Energy of Geopolymer Ferrocement Trough Panels

b. Failure pattern

From the impact test number of blows required to initiation of first crack was based on visual observation and the ultimate failure was determined based on the number of blows required for the crack to propagate to sides of the panels. The impact energy absorbed by the geopolymer panels specimens were computed based on the number of blows required to cause ultimate failure and impact energy per blow. Moreover, the ultimate crack resistances generally increase with increase in volume fraction of reinforcement of the three types of panels, have absorbed higher energy compare to the other types. This may be due to the higher ductility and lesser susceptibility to embrittlement of reinforcement. It also observed that the failure pattern of the specimens exhibited localized failure at the point of contact of the drop-weight and no fragments detached from the specimens as the various layers of the mesh reinforcement helped to hold the different fragments together. It can thus infer that meshes used as reinforcement play a major role in not only improving the impact energy absorption, but also retain/hold the various fragments together. The Failure pattern of panels is shown in the Fig 6 and 7.

Figure 6. Geopolymer Ferrocement Trough Panels at First crack

Figure 7. Geopolymer Ferrocement Trough Panels at failure

V. CONCLUSIONS

Based on the above experimental results, the following conclusions are arrived

1) Increase in the volume of reinforcement the energy absorption is also increased when compared to the control mix.

2) The failure pattern in the impact tested panels is found to be punching shear due to higher reinforcement. Only pure cracks are propagated up to the edge.

3) The energy absorbed at failure is directly proportional to the volume of the reinforcement provided in the Geopolymer Ferrocement panels.

4) Increase in molarity of NaOH also increases first crack impact strength and ultimate impact strength of Geopolymer concrete panels.

5) Geopolymer Ferrocement Trough Panels exhibit excellent impact resistance characteristics, in terms of higher energy absorption and higher I_{rs} values, indicating excellent post-cracking behavior.

6) Geopolymer Ferrocement Trough Panels exhibits higher impact strength, while compared with geopolymer Ferrocement Flat panels based on the experimental test results.

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EXPERIMENTAL STUDY ON IMPACT RESISTANCE OF GEOPOLYMER FERROCEMENT FLAT PANEL

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Abstract— **This paper deals with the study of impact resistance and energy absorption properties of Geopolymer Ferrocement Flat Panel under impact load. Prefabricated elements are used in construction industry as an alternative system to overcome the formwork problems in addition to getting better quality control. The prefabricated elements made of reinforced concrete are extremely heavy and difficult to transport, placing in position and to construct. Alternatively, ferrocement panels are being used in construction industry due to its good structural performance and low cost. Ferrocement is suitable for the construction of roofing/floor elements, precast units, manhole covers, and construction of domes, vaults, grid surface and folded plates. It can also be used for making water tanks, boats, and silos. An experimental investigation on impact behavior of flat ferrocement panels reinforced with skeletal steel and galvanized iron wire mesh is presented. These panels were subjected to impact loading by drop weight test method. It is concluded that Geopolymer Ferrocement Flat Panels with 10M NaOH solution using higher impact energy absorption capacity as compared other geopolymer mixes.**

Keywords— ***Ferrocement, Geopolymer, Wire mesh, Impact load.***

I. INTRODUCTION

Ferrocement is a type of thin wall reinforced concrete commonly constructed of hydraulic cement mortar reinforced with closely spaced layers of continuous and relatively small size wire mesh which may be made of metallic or other suitable materials. Since ferrocement possess certain unique properties, such as high tensile strength-to-weight ratio, superior cracking behavior, lightweight, moldability to any shape and certain advantages such as utilization of only locally available materials and semi-skilled labor/workmanship, it has been considered to an attractive material and a material of good promise and potential by the construction industry, especially in developing countries. It has wide range of applications such as in the manufacture of boats, barges, prefabricated housing units, biogas structures, silos, tanks, and recently in the repair and strengthening of structures.

Ferrocement is suitable for low-cost roofing, pre-cast units and man-hole covers. It is used for the construction of domes, vaults, grid surfaces and folded plates. It can be used for making water tanks, boats, and silos. Ferrocement is the best alternative to concrete and steel. Generally, ferrocement shells range from 10 mm to 60 mm in thickness and the reinforcement consists of layers of steel mesh usually with steel reinforcing bars sandwiched midway between. The resulting shell or panel of mesh is impregnated with an extraordinarily rich (high ratio of cement to sand) Portland cement mortar. Ferrocement is a highly versatile construction material and possess high performance characteristic, especially in cracking, strength, ductility, and impact resistance. As its reinforcement is uniformly distributed in the longitudinal and transverse directions and closely spaced through the thickness of the section. There is an ample scope for mass production and standardization together with the economy in construction.

II. LITERATURE REVIEW

In the experimental work carried out by **G.Murali, E. Arun, A. Arun Prasadh, R. Infant raj and T. Aswin Prasanth *et.al*, (2014)[1],** For this study, five Ferrocement plates with dimensions of 450×450×25mm were casted and tested. The plates were casted with reinforcing bars and different types of reinforcing meshes such as expanded mesh, rectangular welded mesh, welded mesh light and hexagonal mesh. The dimensions of mortar cube are 5 cmx 5cmx5 cm and cement to sand ratio is 1:2. Polypropylene fiber (0.8%) was used in the mix to produce fibrous concrete to improve the concrete characteristics. The impact energy at initial cracking stage and at failure was determined by drop weight (3.5 kg). Higher energy absorption is achieved in the Ferrocement plates using meshes than that of the plates using mild steel. Bars as the reinforcement material. This could be attributed to the effect of mesh in controlling the developed cracks.

In the experimental work carried out by **S. Nagan and R.Mohana (2014)[2]**, they found the resistance of geopolymer mortar slabs under impact load by dropping a steel ball from a considerable height. For this study, they used specimens of size 230 x 230 x 25 mm with different combinations of chicken mesh and rectangular weld mesh and are subjected to impact load by drop weight test and the impact energy required for first crack and final crack were calculated. They found that the combination of chicken mesh and rectangular weld mesh together showed better performance in case of energy absorption and residual impact strength. The compressive strength, flexural strength and split tensile strength of 10M geopolymer mortar specimens are found to be 36.05%, 33% and 27.7% more when compared to cement mortar specimens respectively. Also with increase in volume of reinforcement, energy absorption of geopolymer ferrocement specimen increases compared to cement mortar specimen.

RESEARCH SIGNIFICANCE

In this investigation, the experiments were conducted to understand the structural behavior of Geopolymer Ferrocement Flat Panels under impact loading. The tests were mainly focused on the impact load test of geopolymer Ferrocement Flat Panels with simply supported condition by drop weight test. This paper presents the no. of blows required for first crack stage, ultimate stage, impact load and energy absorption at first crack and ultimate stage.

III. MATERIALS

a. Fly Ash

Fly ash is the most abundantly used mineral admixture as replacement for cement in mortar. It is also the main ingredient for geopolymer mortar due to its active participation in the geopolymerization process. Pozzolanic material exhibits cementitious properties when combined with calcium hydroxide. Fly ash is used as the pozzolana in many concrete applications. Fly ash is used as cement replacement.

b. Fine Aggregate

Fine aggregate used is Trichy River Sand passing through sieve in 4.75mm with specific gravity of 2.62 and having a fineness modulus of 2.80 (IS 383-1971 Zone II).

c. Sodium Hydroxide

Generally, NaOH is available in market in pellets or flakes form with 96% to 98% purity where the cost of the product depends on the purity of the material. The solution of NaOH was formed by dissolving it in water based on the molarity required. It is recommended that the NaOH solution should be made 24 hours before casting and should be used with 36 hours of mixing the pellets with water as after that it is converted to semi-solid state.

d. Sodium Silicate

It is also known as water-glass which is available in the market in gel form. The ratio of SiO_2 and Na_2O in sodium silicate gel highly affects the strength of geopolymer mortar. Mainly it is seen that a ratio ranging from 1 to 1.5 gives a satisfactory result.

e. Wire Mesh

Steel mesh reinforcement is broadly used as the main and characteristic reinforcing for industrial concrete floor slabs, shortcrete. It is also measured for structural purposes in the reinforcement of water tanks, tunnel segments, concrete cellars, meshes help to develop the compressive strength, tensile strength, flexural strength, post peak ductility performance, pre-crack tensile strength, fatigue strength, impact strength and eliminate temperature and shrinkage cracks. The main reason for addition of meshes to mortar is to develop the post cracking response of the concrete, i.e., to improve its energy absorption capacity and apparent flexure.

V. MIX PROPORTION AND EXPERIMENTAL INVESTIGATION

a. Geopolymer Mix Design

Sodium hydroxide concentration	= 10 M
Na_2SiO_3 to NaOH ratio	= 1:1.50
Fly ash to Sand ratio	= 1:1
Alkaline activator to Fly ash ratio	= 0.45
Curing type	= oven curing
Curing period (oven)	= 24 hrs@72°c -75°c

b. Preparation of Alkaline Activator Solution

The mixture of Na_2SiO_3 solution and NaOH solution can be used as the alkaline liquid. The Alkali activator solution has to be prepared before 24 hours of use because at the time of mixing Na_2SiO_3 and NaOH solution it generates a huge amount of heat and the polymerization takes place by reacting with one another, which will act as a binder in the geopolymer mortar. It should be used within 36 hours of mixing the pellets with water as after that it is converted to semi-solid state. The Sodium hydroxide, available in small flakes, is dissolved in water at different proportions as required molarity of solution.

c. Geometry of mould

Geometry shape of Ferrocement Flat panel will be casted using geopolymer mortar and the size of panels. The tested ferrocement panels consist of two Flat panels. The dimensions of the Flat are shown in Fig. (1) which depicts that the horizontal projection of the trough panel is (350x200mm) dimensions. The thickness of the panels is 30mm.The panels are constructed using the conventional ferrocement

materials, which is composed of cement mortar and Galvanizes chicken wire mesh with a hexagonal opening.

Figure 1. Dimensions of the Flat panel

d. Casting of geopolymer ferrocement panels

Special mould was fabricated in metal sheet to match the required geometry of the flat panel. Each sample is molded after fixing the required wire mesh and skeletal steel in its proper position. For the panels with single wire mesh top of the skeletal steel. Then the panels were cast in sodium hydroxide concentration 10M, sodium hydroxide to sodium silicate ratio 1:1.50, fly ash to sand ratio of 1:1 and alkaline activator to fly ash ratio of 0.45 with proper compaction**.** The moulds were coated initially with oil so as to enable easy removal of the moulds. The moulds were placed on an even surface. The surface was painted with waste oil. Cover blocks were used to ensure a clear cover of 5 mm. Normal mild steel bars steel bars (nominal diameters 6 mm) were used as the reinforcing material. The steel reinforcement mat with required spacing was placed inside the moulds.

e. Impact machine set-up

Geopolymer Ferrocement t flat panels were tested under drop weight impact load the impact was conducted using 4.5 kg hammer that was allowed to fall freely from a constant height of 460mm through a guide at the center of the panel for all the specimens with the simple support conditions as per ASTMD 2794.Specimens were placed in their position. The mass was then dropped repeatedly and the number of blows required to cause first crack was recorded. The number of blows required for failure was also recorded. For each panels the number of blows required to cause the first crack was noted. Then the process was continued further, till the crack propagated further and appeared at the top surface of the specimen. At the point, corresponding number of blows were noted. The no. of impact blows required to develop first visible crack was used to calculate the first crack impact strength. The schematic diagram of impact test experimental setup is shown in Figure 2.

Figure 2. impact machine set-up

VI.RESULTS AND DISCUSSION

a. Energy absorption

The mass was then dropped repeatedly and the number of blows required to cause first crack was recorded. Then the number of blows required for the failure is also recorded. Then the process was continued further, till the crack propagated further and appeared at the sides of the specimen. The number of blows required to cause the crack width of 2mm were also noted down. The total energy absorbed by the Ferrocement panels when struck by a hard impactor depends on the local energy absorbed both in contact zone and by the impactor. The energy absorption can be obtained by using the following formula.

$$E = N \times (w \times h) \text{ joules}$$

Where,

E= energy in joules
w= weight in Newton
h= drop height in meter
N= blows in numbers

The ratio of energy absorbed up to the failure of specimens to the energy absorbed at initiation of first crack is defined as the 'Residual Impact Strength Ratio' (Irs). The energy absorption capacities of Ferrocement slab specimens at first crack and at ultimate failure stages are presented.

Table 1 Impact Resistance of Geopolymer Ferrocement Flat Panels

S. No.	Specimens ID	First Crack Resistance – FCR (No. of blows)	Ultimate Resistance – UR (No. of blows)	Percent increase in Resistance from FCR to UR
1	GFP FT 01	4	12	2.0
	GFP FT 02	6	16	1.6

Table 2 Impact Energy of Geopolymer Ferrocement Flat Panels

S. No	Specimens ID	Impact Energy Absorbed (Joules)		Impact Strength Ratio (I_{rs})
		At First Crack	At Ultimate	
1	GFP FT 01	77.69	233.08	3.00
	GFP FT 02	116.54	310.78	2.66

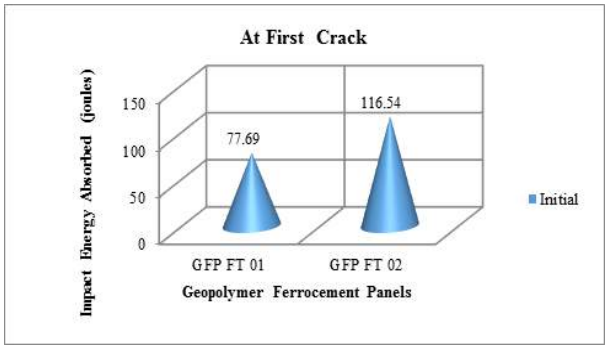

Figure 3 At first crack

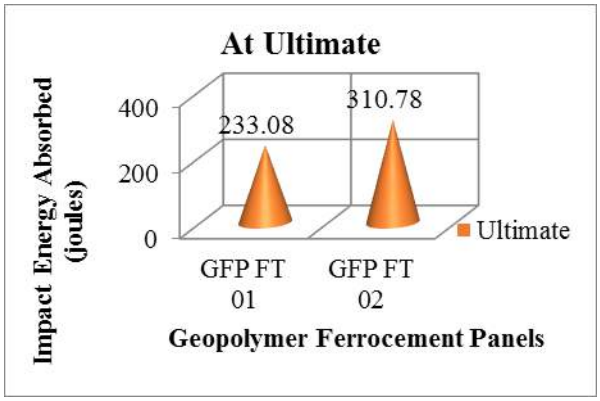

Figure .4 At Ultimate

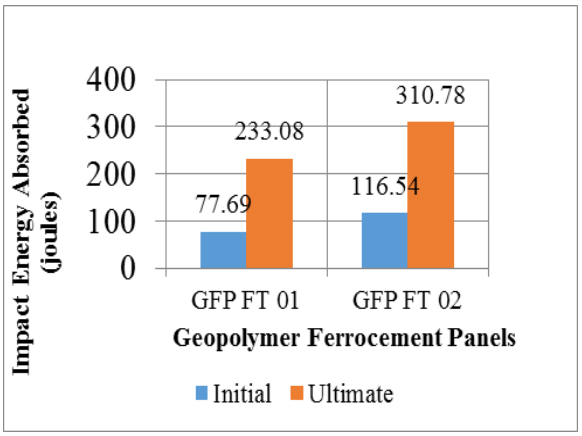

Figure 5. Impact Energy of Geopolymer Ferrocement Flat Panels

b. Failure pattern

From the impact test number of blows required to initiation of first crack was based on visual observation and the ultimate failure was determined based on the number of blows required for the crack to propagate to sides of the panels. The impact energy absorbed by the geopolymer panels specimens were computed based on the number of blows required to cause ultimate failure and impact energy per blow. Moreover, the ultimate crack resistances generally increase with increase in volume fraction of reinforcement of the three types of panels, have absorbed higher energy compare to the other types. This may be due to the higher ductility and lesser susceptibility to embrittlement of reinforcement. It also observed that the failure pattern of the specimens exhibited localized failure at the point of contact of the drop-weight and no fragments detached from the specimens as the various layers of the mesh reinforcement helped to hold the different fragments together. It can thus infer that meshes used as reinforcement play a major role in not only improving the impact energy absorption, but also retain/hold the various fragments together. The Failure pattern of panels is shown in the Fig 6 and 7.

Figure 6. Geopolymer Ferrocement Flat Panels at First crack

Figure 7. Geopolymer Ferrocement Flat Panels at failure

IV. CONCLUSIONS

Based on the above experimental results, the following conclusions are arrived

1) Higher energy absorption is achieved in the Ferrocement panels using meshes then that of the panels using mild steel bars as the reinforcement

materials. This attributed to the effect of mesh in controlling the developed crack s.

2) The failure pattern in the impact tested panels is found to be punching shear due to higher reinforcement. Only pure cracks are propagated up to the edge.

3) The energy absorbed at failure is directly proportional to the volume of the reinforcement provided in the Geopolymer Ferrocement panels.

4) Geopolymer Ferrocement flat Panels exhibit excellent impact resistance characteristics, in terms of higher energy absorption and higher I_{rs} values, indicating excellent post-cracking behavior.

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Experimental Investigation of Solid Block Made With Quarry Dust and Partially Replacing the Cement by Lime Sludge

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Abstract— **In India huge tones of waste materials were generated from industries per annum and also it is estimated as 300 million tones. The toxic waste creates disposal and health hazard problems to environment and humans. Paper industry produces huge amount of solid waste in the form of sludge. This research work deals with the sludge from paper mill and the recycling of sludge into useful products. Paper mill sludge takes huge area for dumping the waste on the land in the form of landfill. Some paper mills incinerates the sludge by creating air pollution problems. To reduce and prevent the pollution problem by paper mill sludge, it is used for replacement of building material and make waste as profitable material for construction purpose. Lime sludge from paper mill were used to produce low cost concrete by blending various ratios of cement. Experimental investigation on strength of concrete and optimum percentage of the partial replacement by replacing cement via 10%, 20%, 30%, and 40% of lime sludge were identified.**

Keywords—Quarry Dust, Lime Sludge, Hollow block. Partially replacing of cement in lime sludge, comressive strength.

I. INTRODUCTION

The cement industry continues to introduce more sustainable practices and products for constructing and maintaining our concrete infrastructure and buildings.

Hypo sludge is a recent arrival among cementitions materials. It was originally introduced as artificial pozzolana while producing paper the various wastes are comes out from the various processes in paper industries.

In cement concrete as a partial substitute of cement which economizes the cost of concrete. Preliminary Test on Materials

A. Testing of cement

1. *Fineness Test of Cement*

Correctly 100grms of cement was weighed and taken in a standard IS sieve no.9 (90 microns).The lumps were broken down and the material was sieved continuously for 15 minutes using sieve shaker. The residue left on the sieve was weighed .This weight does not exceed 5% for ordinary cement. Percentage of residue left on sieve = (weight retained/weight taken) x 100

Result: Percentage of residue left on sieve = 0.4

2. *Consistency Test of Cement*

500 grams of cement was taken and a paste was prepared with 24% quantity of water. After completely filling the mould, shake the mould to expel the air. A standard plunger 10mm diameter and 50mm long was attached and brought down to touch the surface of the paste in the test block and quickly released allowed it to sink to the paste by its own weight. The depth of penetration of plunger was noted down. The second trail was conducted by 25% of water and the depth of penetration was found out. Similarly number of trials was

conducted till the plunger penetrates for a depth of 33 to 35mm from top.

Result: Consistence of given sample of cement = 34 %

B. Testing of Quarry Dust

1. Sieve analysis of Quarry Dust

The sample was brought to air – dried condition before weighing and sieving was achieved after drying at room temperature. The air – dry sample was weighed
Fineness modulus =2.80
Zone conformation = Zone-II

2. Specific Gravity Test of Quarry Dust

The pycnometer was dried thoroughly and weighed as W_1 gram. 200 gram of fine aggregate was taken in the pycnometer and weighed as W_2 gram. The pycnometer was filled with water up to the top. Then it was shacked well and stirred thoroughly with the glass rod to remove the entrapped air. After the air has been removed the pycnometer was completely filled with water up to the mark. The outside of pycnometer was dried with a clean cloth and it was weighed as W_3 grams. The pycnometer was cleaned thoroughly. The pycnometer was completely filled with water up to the top. Then outside of the pycnometer was dried with a clean cloth and it was weighed as W_4 grams.
Result: Specific Gravity of Fine Aggregate (G) = 2.63

C. Testing of Coarse Aggregate

1. Sieve Analysis of Coarse Aggregate

The sample was brought to air – dried condition before weighing and sieving was achieved after drying at room temperature. The air – dry sample was weighed and achieved successively on the appropriate sieves starting with the largest size sieve.
Result: Fineness modulus =4.46

2. *Specific Gravity Test of Coarse Aggregate*

The container was dried thoroughly and weighed as W_1 gram. 800 gram of fine aggregate was taken in the container and weighed as W_2 gram. The container was filled with water up to the top. Then it was shacked well and stirred thoroughly with the glass rod to remove the entrapped air. After the air has been removed the container r was completely filled with water up to the mark. The outside of container r was dried with a clean cloth and it was weighed as W_3 grams. The container was cleaned thoroughly. The container was completely filled with water up to the top. Then outside of the container was dried with a clean cloth and it was weighed as W_4 grams.

Result: Specific Gravity of Coarse Aggregate (G) = 2.62

II. Mix Design

The mix design of concrete is a trial and error method. These guidelines gives the range for coarse aggregate and fine aggregate content and based on the limit the approximate mix design for M30 grade of concrete is obtained.
Proportion:

Cement = 1 (499/499)

F.A = 1.01 (507.04/499)

C.A = 2.25 (1121.93/499)

Therefore ratio =1 : 1.05 : 2.25

W/C = 0.43

III. MATERIALA USED

CEMENT

The ordinary Portland cement conforming to IS: 4031 was used for the preparation of the test specimens.

QUARRY DUST

The quarry Dust used in experimental investigation was quarry sand confirming to zone I of IS: 383 – 1970.

COARSE AGGREGATE

Crushed granite aggregate particles passing through 20mm and retained on 4.75 mm I.S sieve used as natural aggregates which met the grading requirement of IS: 383 – 1970.

LIME SLUDGE

Lime sludge is also known as paper industry waste. It is the byproduct of the paper waste. This hypo sludge contains low calcium and minimum amount of silica. Lime sludge behaves like cement because of silica and magnesium properties.

CHEMICAL PROPERTIS OF LIME SLUDGE

The Chemical Properties of Lime Sludge is added in the concrete Lime sludge is also known as paper industry waste. It is the byproduct of the paper waste. This hypo sludge contains low calcium and minimum amount of silica.
Table.1 Chemical Properties Of Lime Sludge

`S.NO	CHARACTERISTICS	RESULTS
1	Loss on Ignition % by mass, including Moisture	52.28
2	Acid In soluble % by mass	7.27
3	Calcium Oxide as Cao % by mass	35.93
4	Magnesium Oxide As Mgo % by mass	0.86
5	Iron Oxide as Fe_2O_3 % by mass	1.89
6	Aluminum Oxide as Al_2O_3 % by mass	1.09

V.*EXPERIMENTAL INVESTIGATION*

LIME SLUDGE ADDED IN CONCRETE

MIX PROPORTION OF LIME SUDGE

Table.2A MIX PROPORTION FOR LIME SLUDGE

% of Partially Added in Lime Sludge	CEMENT	LIME SLUDGE	QUARRY DUST	COARSE AGGREGATE	W/C RATIO
10%	1.98	0.22	1.9	4.1	0.43
20%	1.76	0.44	1.9	4.1	0.43
30%	1.54	0.66	1.9	4.1	0.43
40%	1.32	0.88	1.9	4.1	0.43

A. Compression Test

The compressive strength test is a mechanical test measuring the maximum amount of compression load a material can bear before fracturing. Due to compression load, the cube or cylinder undergoes lateral expansion owing to poisons ratio effect.

B. Flexural Strength Test

The splitting test is simple to perform and gives more uniform results than other tension tests. Strength determine in the splitting test is believed to be closure to the true tensile strength. Splitting strength gives about 5 to 12% higher value than the direct tensile strength.

It is a method of determining the tensile strength of mortar using a cylinder which splits across the vertical diameter .It is expresses as the minimum tensile stress (force per unit area) needed to split the material apart. The specimen used was 100×200 mm cylinder. The test was performed at 7 and 28 days.

Split tensile strength = $2P/\pi DL$

Where,

P= Compressive load in Kn

L= Length of specimen in mm

D= Diameter of specimen in mm

VI.*SOLID BLOCK*

Compressive strength of Solid Blocks or concrete masonry units are required to know the suitability of these in construction works for various purposes.

Solid blocks are generally made of aggregate and water, Partially replacement of cement in Lime Sludge. Which are usually rectangular and are used in construction of masonry structure. They are available in solid and hollow forms.

VII.RESULT AND DISCUSSION

A.GENERAL

In this study of concrete and compressive strength of partially added in solid block.

B.MECHANICAL PROPERTIES

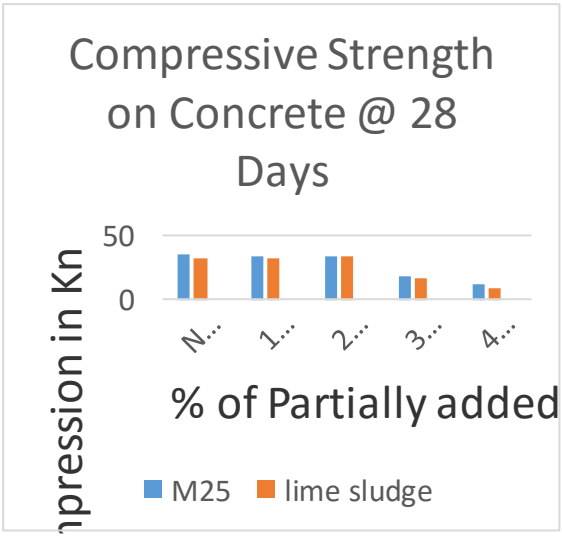
The results of tests were conducted on cement concrete cube and cylinder at 28 days water curing compressive strength, split tensile strength.

C.COMPRESSIVE STRENGTH

Table 4 Compressive strength of concrete

The compressive strength test is a mechanical test measuring the maximum amount of compression load a material can bear before fracturing. Due to compression load, the cube or cylinder undergoes lateral expansion owing to poisons ratio effect

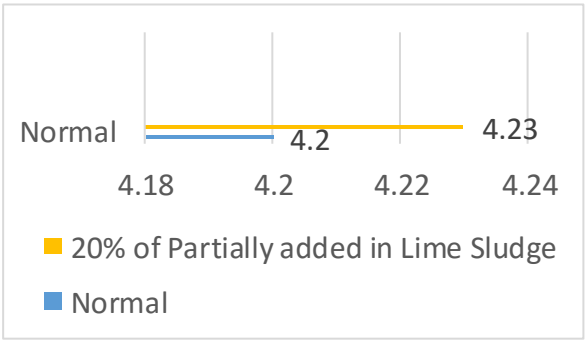
SAMPLES	CUBE
% of Partially Added in Lime sludge	Compressive Strength in Kn
10%	32.88
20%	32
30%	33.77
40%	16
50%	8.9



D.SOLID BLOCK

Result for Compression Test on Solid Block

TYPES OF BLOCK	GRADES OF BLOCK	COMPRESSIVE STRENGTH OF BLOCK in Kn
SOLID BLOCK	Normal block	4.2
	20% of partially added in lime sludge replacing of cement	4.23



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EVALUATION OF LAND USE AND LAND COVER CHANGE DETECTION ANALYSIS USING GIS

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***Abstract*—**

Land use and land cover change detection study over the year 2000-2017 have been carried out for the study area of Oragadam to poonamalle (Kanchipuram District). For this study the Multi Temporal data sets of the years 2000,2010 and 2017 from LANDSAT TM, ETM+ and OLI images of different land use and land cover change have been identified using visual image interpretation techniques. The major part of the study area is covered by Agricultural land which covers about 130.748 sq.km in year 2000,97.373 sq.km in year 2010 and 50.834 sq.km in year 2017;Industrial area which covers about 6.105 sq.km in year 2000,12.183 sq.km in year 2010 and 20.186 sq.km in year 2017;Barren land 16.1782 sq.km in year 2000,38.019 sq.km in year 2010 and 69.805 sq.km in year 2017;Settelement area which covers about 31.144 sq.km in year 2000, 63.843sq.km in year 2010 and 93.748 sq.km in year2017;water body which covers about 31.0177 sq.km in year 2000,50.921 sq.km in year 2010 and 20.190 sq.km in year 2017.The output maps were Analysed and Digitilized. After the analysis of land use and land cover change detection we conclude Agriculture area are reduce and urban areas are Increased..

Keyword--ArcGIS10.2,Kanchipuramdistrict,GIS,Land use,Land cover,Remote sensing

I. INTRODUCTION

Land use land cover change detection analysis is essential for planners to understand land use changes in urban areas for planning sustainable development. With the dynamic urbanization and industrialization process, there is an increasing pressure on land, water and environment causing pollution, traffic congestion, and infrastructure pressure, rising taxes and neighborhood conflicts particularly in the

metropolitan cities. Urban sprawl is the scattering of new development on isolated tracts, separated from other areas by vacant land. Urban extend has been criticized for inefficient use of land resources and large encroachment onto the agricultural lands. Due to the large scale urban extend, the cities are expanding in all directions with changes in land use pattern.

Remote sensing has great potential to study land use and land cover changes Nowadays high resolution spatial imagery are available from satellite like worldview. An important part of land use and land cover change is to obtain information about the geometric elements of different classes.

II OBJECTIVES OF THE STUDY:

- To identify the spatial and temporal pattern land use and land cover change using Remote sensing and GIS
- To identify driving factors of urban growth using satellite images for different years.

- To validate the urban development of the study area using change detection analysis.

III LITERATURE REVIEW

Evaluation of Land Use and Land Cover Changed Detection Using RS & GIS A Model Study From Vijayawada,AP (Arjun dhakal) how to prepare the Land use and land cover change has become a central component in current strategies for managing natural resources and monitoring environmental changes. Urban expansion has brought serious losses of agriculture land, shrub, barren land and water bodies.In this project an attempt is made to study the changes in land use and land cover in Vijayawada region over period of time i.e. from 2002 to 2012.the study has been done through remote sensing approach using land sat imageries of this region.

Application of land change modeler for prediction of future land use land cover for Vijayawada city (k.sundara kumar) how to predict and analyse the present and future growth of vijayawada city of the year 1973,2001,2014. to predict the land use and land cover images of 2030 to 2040 of using terrset software..A total area 85515.75 hectares was taken as study area which has potencial for expansion. Prediction of future lulc image will be helpful for proper planning of urban environmental management.an accuracy of more than 80% was obtained in all stages. the output images were analysed and presented.

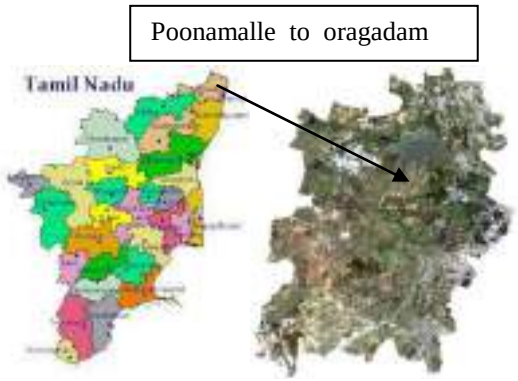
Land use and land cover change detection study over the year 1990-2001 have been carried out for the study area of usilampatti block in Madurai district.(Pradeep.c)discuss this paper to predict and analyse the present and future growth of USILAMPATTI BLOCK of the year 1990,2001 This data can be recorded and can be compared with future data to find out the impact of humans on the natural environment and natural changes.the finding are major part of the study area is agricultural land, which covers about 86.5 sq.km in 1990 and 67.288sq.km in2001;wasteland covers about 68.371sq.km in 1990 and 76.233 sq.km in 2001 build up covers about 1.976sq.km in 1990 and 2.68sq.km in 2001.Thus the output images were analysed and presented.

Dhanasekarapandian.MSelvan.p,chandran.s,chandra mohan have discussed about the change of land use and land cover using quantitative method to expound the impact of land use and land cover in Giruthumalriver sub basin from a period of year 1990 to 2010.To analyse the dynamic nature location and magnitude of changes within the land use classes for the period 1990 to 2010The result of poor irrigation facility and could not be regular monitoring of land activities the satellite images of study area acquired during 1990 to 2010 periods have offered a rich source of information about land use and land cover change detecting and assessing.land use changes have been detected by image processing method in ERDAS imagine 8.5 and Arc GIS 9.3.Thirteen land use classes have been identified and growth truth observation was also performed to check the accuracy of the classification.the present study has brought to light that the agricultural land that occupied about 29.86% of basin area in 1990 and was decreased to 18.13% of basin area in 2010 and settelement increased 9.8% of total area of basin in 2010.

Identification and monitoring the change of land use pattern using remote sensing and GIS (Asif mahmood) have discussed how to predict and Analyse the present and future growth of Dhaka city of the year 1990,2003,2010. This data can be recorded and can be compared with future data to find out the impact of humans on the natural environment and natural changes. the output images were analysed and presented.the remotely detected land use and land cover change from 1990 to 2010 shows that Dhaka is gradually changing as vegetative cover and open spaces have been transformed into buildings areas,low land and water bodies into reclaimed build up lands. These changes are mainly governed by unplanned urban expansion.this paper presents an integrated study of urbanization trends in Dhaka city.dhaka is a sheer examble of having poor legislative actions inefficient management and lack of public awareness which leads the urbanization to an unplanned and resource consuming development.

IV DESCRIPTION OF STUDY AREA

The study area is chosen based on the preliminary investigation of growth patterns in Chennai Metropolitan Area (CMA). The study area is located in the periphery of Chennai city which has rapid urban development resulting large land use change in the last decade due to the development activities in the area and Oragadam, Sriperumbudur taluk of Kanchipuram district is a fastest growing suburb in Chennai metropolitan area. It is located in the strategic location between NH45 and NH4. It is also known as the biggest automobile hub in south asia. Poonamalle is a fastest developed area with a population of 57,224(2011 census).



III DATA AND METHODOLOGY

3.1 Data Collection

This research is dependent on secondary data. To prepare the base maps for analysis purpose and applying the different methods to achieve the study objectives, Landsat satellite images (2000, 2010 and 2017) have been collected from *Knchipuram Space Research & Remote Sensing Organization* (*SPARSO*). Table shows the details of the Landsat satellite images used for analysis from Land sat-5,Land sat -7 ETM+, Land sat -5-TM.Map Projection of the collected satellite images is Universal Transverse Mercator (UTM) within Zone 46 N–Datum and of the co-ordinate system World Geodetic System (WGS) 84 and the pixel size is 30 meters.

3.2 DATA PREPARATION

The collected images are pre-processed by radiometric or geometric corrections. Radiometric corrections include correcting the data for sensor irregularities and unwanted sensor or atmospheric noise, and converting the data so they accurately represent the reflected or emitted radiation measured by the sensor.

Image enhancement is solely to improve the appearance of the imagery to assist in visual interpretation and analysis. Contrast stretching has been performed to increase the tonal distinction between various features in a scene, and spatial filtering to enhance (or suppress) specific spatial patterns in an image. Arithmetic operations (i.e. subtraction, addition, multiplication, division) are performed to combine and transform the original bands into "new" images which better display or highlight certain features in the scene. The image pre-processing, enhancement and transformation operations are done using Arc GIS 10.2.

3.3 LAND USE / LAND COVER CLASSIFICATION

Using the basic colors red, green and blue (RGB), it is possible to prepare different images. To distinguish between different cover types or ground objects like buildings, roads, and vegetation, these images are useful. We have choose the FCC of RGB= bands 4, 3 and 2 for this study. This combination normally makes built-up areas appear blue, vegetation red, water bodies from dark blue to black, soils with no vegetation from white to brown.

Image classification refers to grouping image pixels into categories or classes to produce a thematic representation. Image classification comprehends various operations that can be applied to photographic or image data. These include image restoration, image pre-processing, enhancement, compression, spatial filtering, and pattern recognition and so on. There are two basic methods of image classification: supervised and unsupervised. Supervised classification relies on the priori knowledge of the study area. Therefore, for this study, a supervised classification method has been used.

3.4 IMAGE CLASSIFICATION

After developing training samples for all land cover classes the next step is to classify the images based on these training samples. This has been done using the Interactive Supervised Classification Toolbar in ArcGIS 10.2. This latest version of ArcGIS enables us to perform the land cover classification without creating any signature files, which was primitive for the older versions.

Land use/cover types	Description
Water bodies and Wetlands	River, permanent open water, lakes, ponds and reservoirs :Permanent and seasonal wetlands, marshy land, rills and gully, swamps
Built-up	Residential, commercial and services, industrial, transportation, roads, mixed urban, and other urban
Vegetation and cultivated land	Deciduous forest, mixed forest lands, palms, conifer, scrub and others Crop Fields, Fallow lands and vegetable lands
Bare soil/Exposed soil	Exposed soils, sand fill, landfill sites, and areas of active excavation

3.5 Generalization

Sometimes many isolated pixels may be found after image classification . These isolated pixels belong to one or more classes that differ from surrounding pixels. Therefore it is necessary to generalize the image and remove the isolated pixels. Filtering is the solution for this type of problem. After a vector-to-raster conversion, mode filters are good for filling gaps between polygons. Therefore, a 3×3 mode filter

has been applied to generalize the supervised classified land cover images. This post-processing operation replaces the isolated pixels to the most common neighboring class. Finally the generalized image is reclassified to produce the final version of land cover maps for 2000, 2010 and 2017.

3.6 Image pre-processing

The set of Landsat ETM+ data were initially geo-corrected and rectified. The whole scene sizes of the satellite imagery of ETM+ data were cropped to the study area. The study area includes Chennai city administrative area and a 10km buffer from the city boundary. The final subset imagery of the study area was obtained using ENVI Imagine for further classification Of all the various data sources used in GIS, one of the most important is undoubtedly that provided by remote sensing. Through the use of satellites, we now have a continuing program of data acquisition for the entire world with time frames ranging from a couple of weeks to a matter of hours. Very importantly, we also now have access to remotely sensed images in digital form, allowing rapid integration of the results of remote sensing analysis into a GIS The development of digital techniques for the restoration, enhancement and computer-assisted interpretation of remotely sensed images initially proceeded independently and somewhat ahead of GIS. However, the raster data structure and many of the procedures involved in these *Image Processing Systems* (IPS) were identical to those involved in raster GIS. As a result, it has become common to see IPS software packages add general capabilities for GIS, and GIS software systems add at least a fundamental suite of IPS tools. IDRISI is a combined GIS and image processing system that offers advanced capabilities in both areas.

3.7 Landuse

The Landuse of the study area were interpreted from satellite images using GIS, which consisted of differentclasses.Landuse with consistent classification for two time periods is needed for the calibration of model. Input data for the study area prepared as a subset of main image. The collected images are pre-processed by radiometric or geometric corrections.radiometric corrections include correcting the data for sensor irregularities and unwanted sensor or Admospheric noise and converting the data so they accurately represent the reflected or emitted radiation measured by the sensor. Image enhancement is solely to improve the appearance of the imagery to assist in visual interpretation and analysis.contrast stretching has been performed to increase the tonal distinction between various features in a scene and spatial filtering to enhance specific spatial patterns in and Image.Arthmeticoperations(Addition,subtraction,multiplication,Division)areperforme to combine and transform the original bands into new images which better display are certain feautures in scene.the image preprocessing enhancement and transformation operations are done using ARG GIS 10.2.

3.8 Excluded areas

Exclusion is defined as areas which are resistant to urbanization.Excluded area chosen for this analysis includes water bodies of tanks and canals. These areas are mainly extracted from the classified land cover data.

3.9 Urban extent

Satellite imageries of the study area for the year 2000, 2017 and have geo referenced using Arc GIS. Landsat images of resolution 30m and 15m was used for on-screen digitization of the extent of built structures.

3.10 Population density

The population data were collected from census of India for 2000, 2010 and 2017. The density maps were prepared using population data and urban map in Arc GIS. Table 3.2 represents the village population census.

TABLE 3.2 POPULATION CENSUS DATA

	POPULATION				POPULATION		
VILLAGE NAME	2000	2010	2017	VILLAGE NAME	2000	2010	2017
Alapoor	127	286	302	Navalur	629	758	3539
Amarambedu	576	894	1187	Neelamangalam	675	1042	1575
Ammanumbakkam	40	85	390	Oddankaranai	521	610	923
Arambakkam	390	513	1242	Oragadam	658	822	1985
Athanancheri	1239	2334	3668	Orathur	1124	1549	1744
Ayyancher	467	820	1121	Padappai	6713	8285	14063
Chembarambakkam	819	878	1505	Panapakkam	103	143	458
Erumaiyur	618	2047	2379	Pazhanthandalam	2962	3359	4777
Gundueperumbedu	389	566	1020	Peerkankaranai	10986	17511	25871
Irumbedu	236	308	323	Perinalur	1168	1604	2610
Irungattukottai	1219	1439	3904	Perinjambakkam	231	393	1379
Kadaperi	5798	93	157	Perungalathur	12376	19594	37342
Kaduvancheri	349	405	484	Pillaipakkam	1093	1747	1741
Kanchivakkam	398	479	644	Posnamallee	28832	42612	64213
Karanaithangal	97	122	182	Posnthandalam	568	1009	3117
Karasangal	1980	2215	3858	Puduchen	239	336	815
Katrambakkam	1177	1453	2157	Putuppair	458	551	788
Kavalkazhani	38	53	140	Pulikaradu	219	345	325
Kavanur	1006	2104	1586	Salamangalam	1127	1129	2547
Keelakal	107	142	281	Serapanacheri	734	866	976

Kilambakkam	6791	18455	26865	Sethupattu	658	809	1027
Kolathur	686	985	1374	Sikkarayapuram	7230	8763	10187
Kollachen	1979	2089	5793	Sirukalathur	1285	2348	6117
Konalkanthangal	678	737	903	Sirumathur	782	879	1084
Kovur	3086	5648	10961	Somangalam	2998	3569	4376
Kozhumanivakkam	644	1260	2709	Tamberam	19687	25694	389718
Kundrathur(TP)	25137	27128	42126	Thandalam	2074	2688	5546
Madaviagam	123	562	828	Thirumudivakkam	1264	3027	4083
Maharajan	798	835	1860	Thiruneermalai(TP)	14569	19218	30702
Malaipattu	810	883	1078	Thundalkalani	973	1122	781
Malayambakkam	3598	5025	8250	Tirunageswaram	567	652	821
Mangadu	11235	22127	38188	Tukkanampakkam	2084	2864	3425
Manimangalam	4872	5163	8298	Urapakkam	9693	13445	29122
Manivakkam	2844	9783	13808	Vaipoor	1003	1316	1803
Mathur	453	732	1628	Valarpuram	1361	1965	2368
Mevalurkuppam	5134	4230	5798	Vandalur(CT)	5767	13875	16852
Mudichur	2150	3673	15438	Varadarajapuram	474	1973	5846
Nadueerampattu	2594	4517	6291	Vattambakkam	413	560	663
Nallamperumbedu	43	85	168	Vellarai	230	379	426
Nallur	779	741	4618	Vellerithangal	84	108	185
Nandambakkam	1782	9343	11239	Vengadu	721	999	1011
Nandivaram	21874	26576	44088	Venjuvancheri	330	406	649
Naniyambakkam	376	422	566	Venkatapuram	928	1210	2137

RESULTS AND DISCUSSION

4.1 INTRODUTION

The quality of the input data and the selection of optimal parameter ranges should be considered carefully to improve the calibration result. The calibration process has resulted in the determination of a set of land use and land cover change to quite accurately simulate the observed growth in the study area.

4.2 LANDUSE

Landuse map is prepared by onscreen visual interpretation of satellite map. The NRSC level II classification is adopted for mapping. A Landuse interpretation key for Agricultural land, urban area, barren land, forest area, dense scrub, scrub land and water body classes were used for Landuse map preparation.

Fig 4.1, 4.2 and 4.3 for the year of 2000, 2010 and 2017.

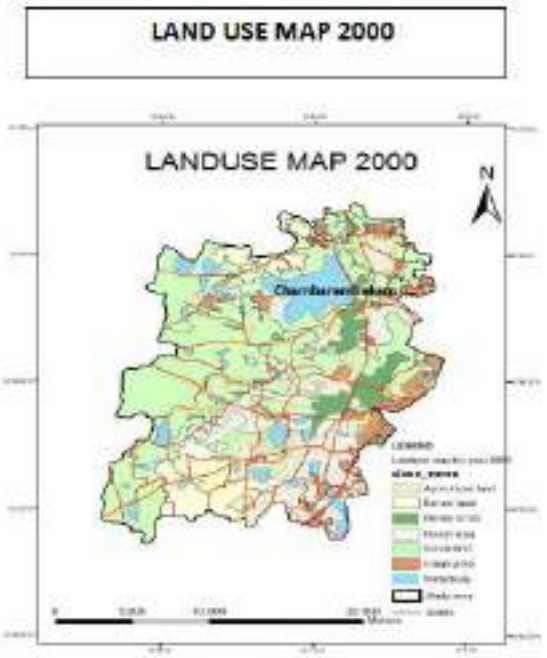


Fig 4.1 Landuse map of the study area in the year of 2000

DESCRIPTION	AREA IN Sq.kms
AGRICULTURE LAND	130.74834
INDUSTRIAL AREA	6.30571
BARREN LAND	16.1790
SETTLEMENT	31.144485
WATER BODY	31.017724

Fig 4.2 Land use map of the study area in the year of 2010

DESCRIPTION	AREA IN Sq.kms
AGRICULTURE LAND	97.373152
INDUSTRIAL AREA	12.383452
BARREN LAND	38.019873
SETTELMENT	63.84378
WATER BODY	50.921662

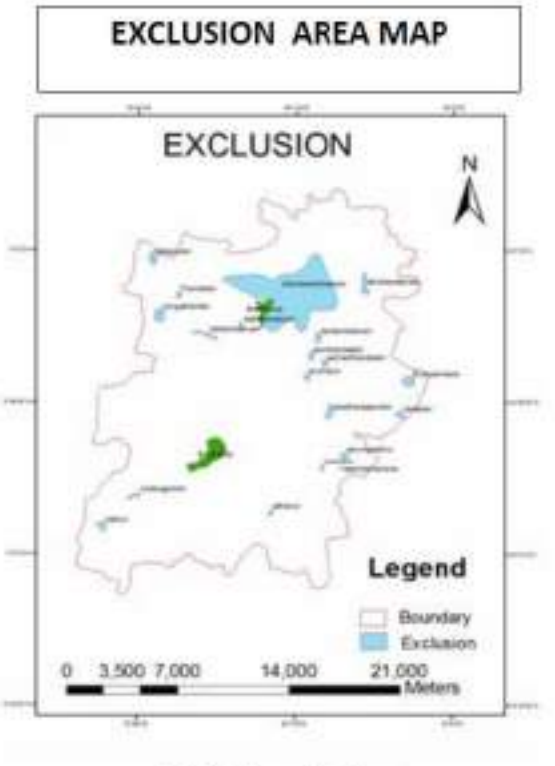


Fig: 4.4 Excluded area of the study area

Fig: 4.3 Land use map of the study area in the year of 2017

DESCRIPTION	AREA IN Sq.kms

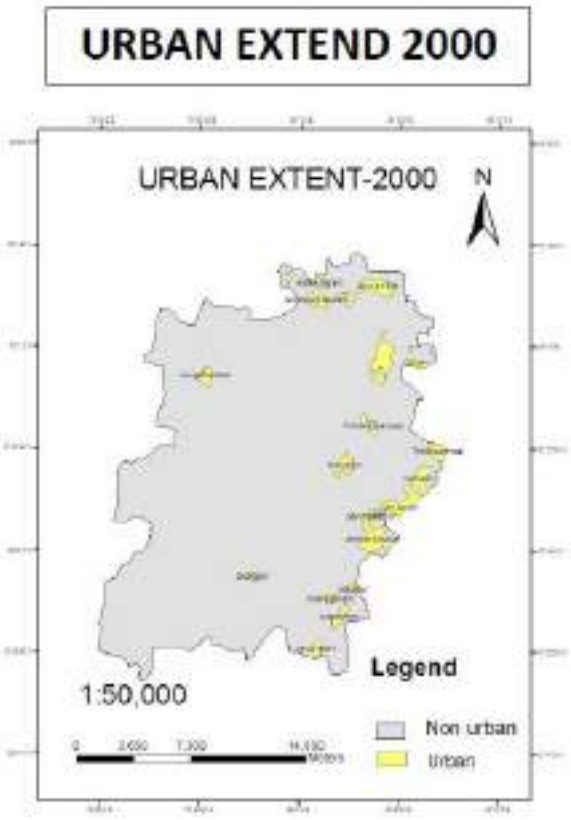


Fig: 4.5 Urban extent area of the study area 2000

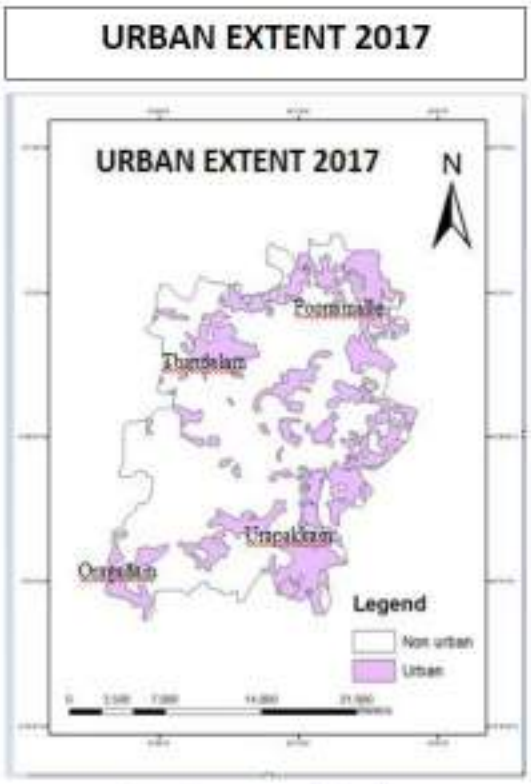
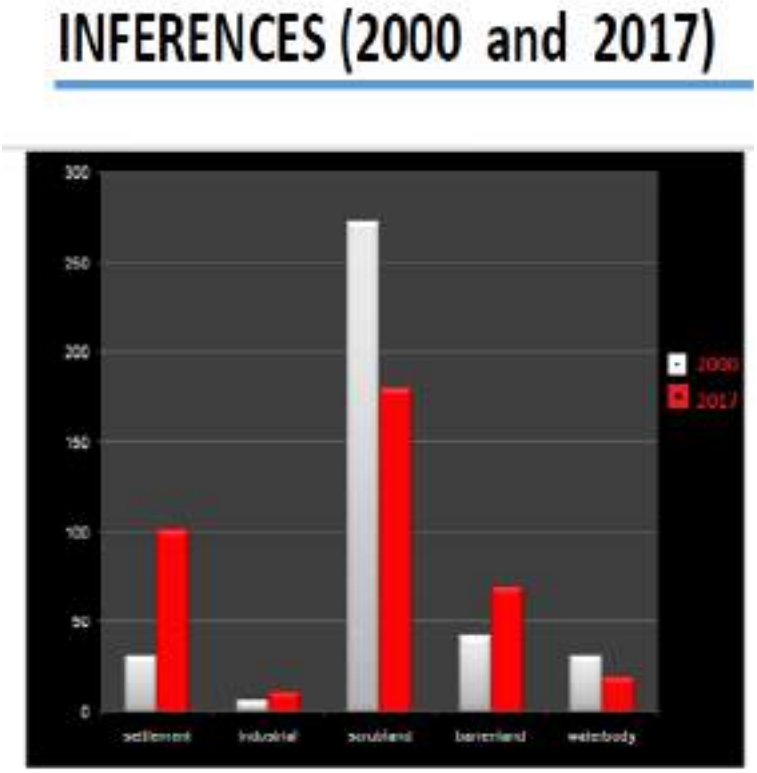
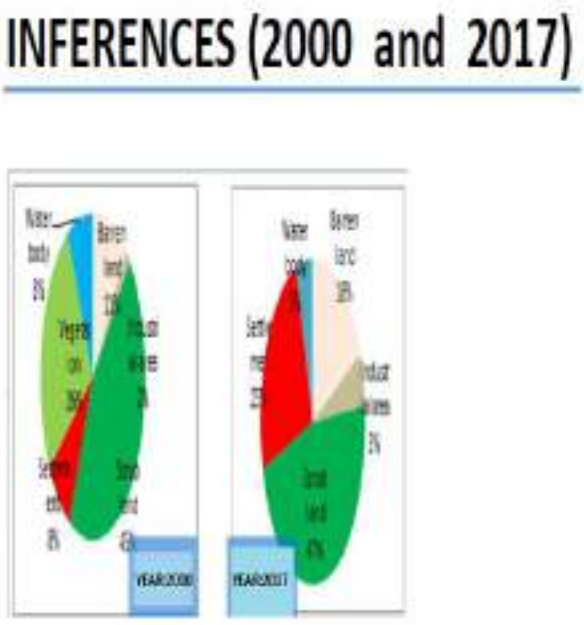


Fig: 4.6 Urban extent area of the study area 2017





V CONCLUSION

Land use and land cover classification of oragadam to poonamalle area of kanchipuram district using remote sensing and GIS was described in the study. landsat images of oragadam to poonamalle area of kanchipuram district of year 2000, 2010, 2017 are analyzed by moderately accurate interactive supervised classification toolbar in Arc GIS 10.2 . And various land feautures are delineated, compiled and prepared. The areas of each class were estimated and finally general land use maps for both 2000, 2010,2017 data were prepared. Remote sensing has changed the way of resource evolution studies with the use of multi temporal satellite data it has become increasingly possible to monitor the state of the resource and land use and land cover changes has been successfully monitored. In the present study various resources were identified in which the agricultural area is the predominant land use, since most of the build ups are rural settelements. By proper management of irrigation systems agricultural areas can be increased check dams can be build in the foothills to preserve water so that the ground water level will increase in those area. This will directly

help in agricultural production. Government can conduct awareness programs with the help of NGOs to the local villagers in order to develop the waste lands in to usable agricultural lands. The agricultural areas need more and immediate attention since 70% of the country's population depends.

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We highly thank **Dr.M.SHAHUL HAMEED M.E., Ph.D., M.B.A., Ph.D**., Dean (Research) and Head of the Department of civil engineering for his guidance, encouragement and constant support.

We wish to thank our guide Ms. **S. KALPANA M.E** for abiding interest in fastening the steady progress of our project.

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An Experimental Study on Shear Strength of Flexural Member Using 2-side Inclined Continuos Stirrups

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***Abstract*— A beam is a horizontal flexural member which provides support to the slab and vertical walls. A normal beam(simply supported) consist of two zones generally arise, compression zone at top and tension zone at bottom. Our aim is to reduce the shear failure of the structure and reduction in cost and time for make a stirrup without losing its strength and serviceability in the structural design. In this paper, an experimental Study on shear strength arrested concrete has been done to create reduction in shear crack and savings in materials. Hence we are comparing a 2-side inclined reinforced Stirrups(RC-2S) with a reinforced concrete Conventional beam (RC-CB) in terms of flexural strength. The beam is investigated in terms of crack load and deflection curves.**

Keywords—2S (2-Side inclined stirrups), flexural strength, deflection, beam, compression zone, tension zone

I. INTRODUCTION

A beam is a structural element that primarily resists load applied laterally to the beam's axis. Its mode of deflection is primarily by bending. The loads applied to the beam results in reaction forces at the beam's support points. The total effect of all the forces acting on the beam is produce shear forces, bending moments and deflections of the beam. Beams are characterized by their manner of supports, profile (shape of cross-section), length and their materials Beams must also have an adequate safety margin against some type of failures such as shear, which may be more dangerous than flexural failure. The shear forces create additional tensile stress that must be considered. Shear failure of reinforced concrete beam, more properly called *diagonal tension failure* is difficult to predict accurately. In spite of many years of experimental research and the use of highly sophisticated computational tools, it is not fully understood. If a beam without properly designed for shear reinforcement is overloaded to failure, shear collapse is likely to occur suddenly. With no shear reinforcement provided the member failed immediately. So shear reinforcement should be provided to resist these shears which created on the beam. A flexural member designed to carry uniform or concentrated line loads. A beam may act as a primary member in beam-column frames, or may be used to support slabs. A beam is a structural element that is capable of withstanding load primarily by resisting against bending. The bending force induced into the material of the beam as a result of the external loads, own weight, span and external reactions to these loads is called a bending moment. It is equal or slightly larger than the failure stress in tension. Flexural strength, also known as modulus of rupture, or bend strength, or transverse rupture strength is a material property, defined as the stress in a material just before it yields in a flexure test. Stirrups are a reinforcement, that are provide to resist the shear which induced on beams**.** The use of stirrups is needed to prevent the columns and beams form buckling. Stirrups are sometimes placed diagonally and often vertically as well. This is done to prevent shear failure which is usually diagonal in case of cracks in beams. The primary reason for the diagonal shear is due to compression and tension

caused by transverse and vertical tension. Eventually diagonal tension occurs since concrete is stronger in compression as compared to tension. This tension is bound by steel stirrup which holds the cracked surface together. The spacing of the stirrup along the beam is important and should ideally be specified by the designer. This will help the stirrups to be manufactured accordingly. They are usually placed in places where there are high chances of shearing such as beneath large load and bearing points. Concrete is made strong by running bars of steel through them. However, stirrups are used to keep everything in a straight line. Stirrups help keep order and also add strength to the structure at critical points of probable vulnerability from use over time. Steel rebar are stronger than stirrups. However, often it is seen that stirrups are used along with rebar. While rebar act as the bones of the concrete, the stirrups aid the rebar to remain straight and provide enhanced backing to the column of concrete inside which it is placed. Stirrups help secure much needed resistance. When the pressure from above comes down on the column, the stirrups act like tendons. They help the rebar and concrete provide sustainable support for the extreme amounts of load. Stirrups are an essentially high strength steel wire which helps the concrete columns just as the windows are held together by metal wires.

2. LITERATURE SURVEY

This Experimental study was conducted on RCC beams to investigate the strength and shear resisting capacity of various shear reinforcements such as traditional shear reinforcements, inclined shear reinforcements, combination of vertical and inclined shear reinforcements and vertical shear reinforcements with inclined cross bracings. The various parameters like load deflection characteristics, strength characteristics, shear cracks and failure mode of concrete were investigated. It was found that the shear reinforcement configuration influence the strength characteristics of the beam.
This literature state that there was an improvement in the shear resistance and stiffness was observed in inclined stirrup system in comparison with traditional stirrup system.

This paper presents an experimental investigation to clarify shear cracking behavior of reinforced concrete beams. The effects of the various influential parameters on the spacing between shear cracks and the relationship between shear crack width and stirrup strain at the intersection with shear cracks were carefully investigated. It was found that the shear crack width proportionally increases with both the strain of shear reinforcement and with the spacing between shear cracks.

This paper explains that the shear failure of reinforced concrete beam is often sudden and catastrophic. This sudden failure, due to, shear, made it necessary to explore more effective ways to design reinforced concrete beam for shear. The reinforced concrete beam show different behavior at the failure stage in shear compare to bending, which is considered to be unsafe mode of failure. The shear cracks progressive rapidly without sufficient advanced warning, and the diagonal cracks that develop due to excess shear forces are considerably wider than the flexural cracks. The cost and safety of shear reinforcement in reinforced concrete beams led to study of other alternatives. Bent-up bars have been used in the past. New form of bent-up bars will be used. Cross bars will be welded to these bent-up bars making rectangles capable of resisting shear in a plane compare to single bar performance. The main purpose is to identify the most efficient shape to carry shear forces at the lower cost. Several reinforced concrete beams were carefully prepared and tested in the lab. This literature explains the deflection of each beam is measure at applied load. The propagation of shear cracks was also closely monitored. This literature explains the shear cracking behavior in reinforced concrete beams with shear reinforcement clearly.

This paper explains test results of six large-size concrete beams reinforced with either conventional- or high-strength steel and tested up to failure. The beams were constructed without web reinforcement to evaluate the nominal shear strength provided by the concrete. The shear behavior, ultimate load-carrying capacity, and mode of failure are presented. The applicability of the current ACI design code to large-size concrete beams constructed without web reinforcement is discussed. The influence of the shear span depth ratio, concrete compressive strength, as well as the type and the amount of longitudinal steel reinforcement is investigated. The study shows that using high-strength steel alters the mode of failure from diagonal tension to shear compression failure and results in higher shear strength compared with using conventional steel. It was also found that the current ACI shear design provisions are unconservative for large-size concrete beams without web reinforcement. This literature clearly explains the shear behavior of large concrete beams that reinforced with high strength steel.

The shear transfer mechanism greatly depends on the diagonal compressive field in case of such loading condition, so concrete would be significant in the shear resistance. The past proposed equations of shear strength of reinforced concrete members are derived from the test results in the above mentioned loading condition. But there are member that are subjected to shear with the diagonal tension like as footing beams in high rise building, and the members should be designed considering the shear transfer

mechanism depended on the diagonal tension field. The experimental study was carried out to investigate the shear behavior of such members. This literature clearly explains the influence of the loading condition in RC beams on the shear resistance and strength in presented.

3. METHODS AND MATERIAL PROPERTIES

3.1 Methodology:

Mix design of M40 concrete was done with various type of reinforced stirrups beam. The curing was done for 7, 14 and 28 days, after that the hardened tests of compressive, flexural and tensile were made on specimens for the strength test.

Material	Test	Result
Cement	Specific gravity	3.15
	Consistency	35%
	Fineness	1.00g for 100g of cement
Fine aggregate	Specific gravity	2.61
	Fineness modulus	0.592
Coarse aggregate	Fineness modulus	0.45
	Impact	18.2%

4. RESULTS AND DISCUSSION

Compressive strength is most important property of the hardened concrete. The concrete cubes were casted, cured and tested accordance with the IS standard and 7 & 28 days. Compressive strength result of concrete are listed in Table4.1. The highest compressive strength value is 42.08 $N/^{mm2}$ which is obtained at 28 days

Table 4.1Compressive Strength

SPECIMEN	7 DAYS (N/mm^2)	28 DAYS (N/mm^2)
CONVENSIONAL	27.26	42.08

4.2 Flexural Test for beam:

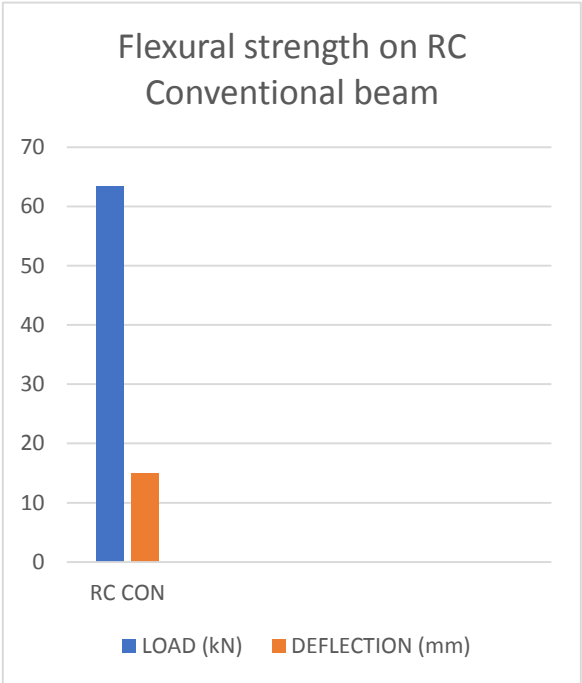
The flexural test were carried at 28 days beam

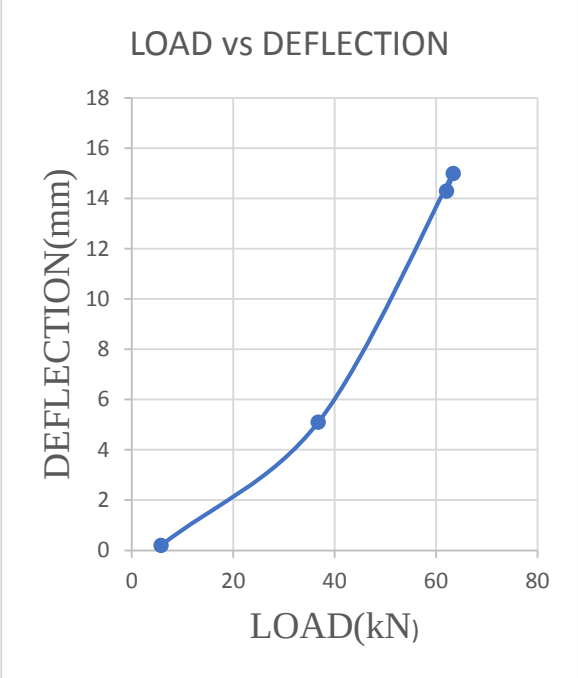
4.2.1 Flexural Test for Conventional beam:

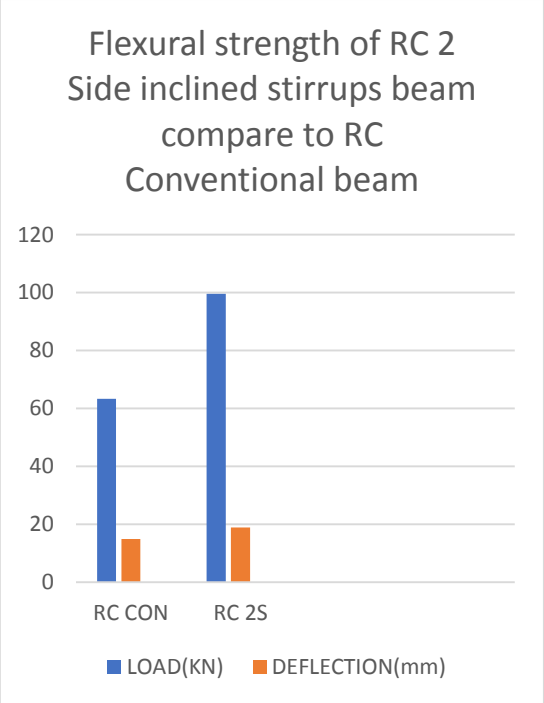
Load cell = 0

Channel (LVDT) = 9

SI.NO	LOAD(kN)	Deflecion (mm)
1	5.8	0.2
2	30.3	2.6
3	36.8	5.1
4	63.4	15.0





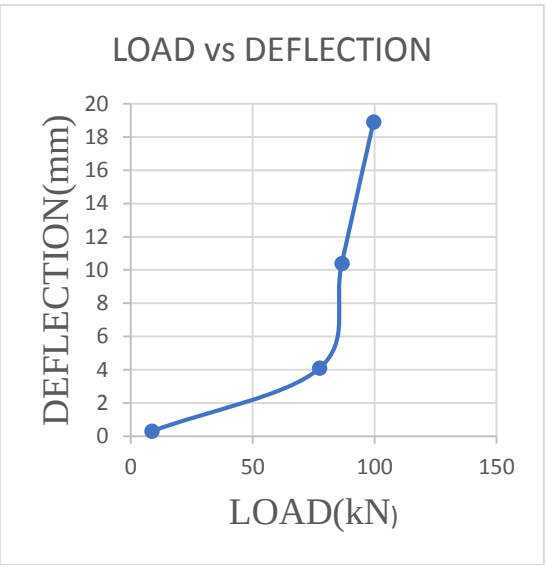


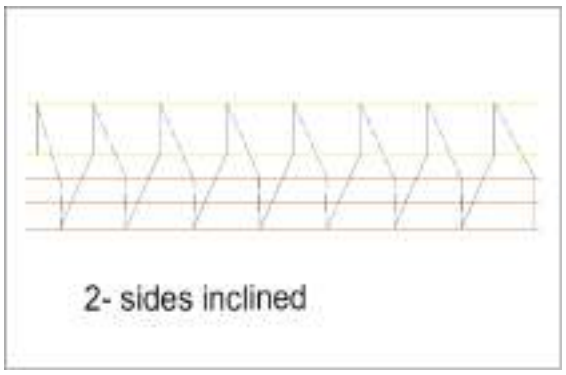
4.2.2 Flexural Test for RC-2S beam:

Load cell = 0

Channel (LVDT) = 9

SI.NO	LOAD(kN)	Deflecion(mm)
1	8.6	0.3
2	77.5	4.1
3	86.6	10.4
4	99.6	18.9





5. CONCLUSION

- The conventional reinforced concrete beam has the ultimate load carrying capacity of 63.4kN and deflection maximum of 15mm.
- The two side inclined reinforced stirrup concrete beams has a ultimate load carrying capacity of 99.6kN and a deflection maximum of 18.9mm, while comparing this with the previous two beam specimen it carried a huge amount of load and resist the shear in a massive way.

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Experimental Study on Fly Ash Based Geopolymer Concrete Paver Block

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Abstract—**Presently, the world is experiencing a drastic climatic change which occurs due to the increase in the amount of greenhouse gasses. CO_2 is one among the gasses that contribute to the greenhouse effect. Production and usage of cement contributes to 40% of the total CO_2 emitted into the atmosphere. Environmental responsibility has initiated in sustainability and eco friendly methods of infrastructure development. In future, there is going to be a time when there will be scarcity for cement and water. So, we have adopted geo- polymer concreting method to produce paver block which doesn't require cement and water. Also we are doing a comparative study between conventional paver block and geo polymer paver block, under the discipline of strength, cost and eco-friendliness.**

Keywords—geopolymer; green house gases; sustanability; eco-friendliness.

I. INTRODUCTION

Davidovits (1988; 1994) proposed that an alkaline liquid could be used toreact with the silicon (Si) and the aluminum (Al) in a source material of geological origin or in by-product materials such as fly ash and rice husk ash to produce binders. Because the chemical reaction that takes place in this case is a polymerization process, he coined the term 'Geopolymer' to represent these binders. Geopolymers are members of the family of inorganic polymers. The chemical composition of the geopolymer material is similar to natural zeolitic materials, but the microstructure is amorphous. The polymerization process involves a substantially fast chemical reaction under alkaline condition on Si-Al minerals that result in a three-dimensional polymeric chain and ring structure consisting of Si-O-Al-O bonds (Davidovits, 1994).

This water, expelled from the geopolymer matrix during the curing and further drying periods, leaves behind discontinuous nana-pores in the matrix, which provide benefits to the performance of geopolymers. The water in a geopolymer mixture, therefore, plays no role in the chemical reaction that takes place; it merely provides the workability to the mixture during handling. This is in contrast to the chemical reaction of water in a Portland cement concrete mixture during the hydration process.

There are two main constituents of geopolymers, namely the source materialsand the alkaline liquids. The source materials for geopolymers based on alumina-silicate should be rich in silicon (Si) and aluminum (Al). These could be natural minerals such as kaolinite, clays, etc. Alternatively, by-product materials such as fly ash, silica fume, slag, rice-husk ash, red mud, etc could be used as source materials. The choice of the source materials for making geopolymers depends on factors such as availability, cost, type of application, and specific demand of the end users. The alkaline liquids are from soluble alkali metals that are usually Sodium or Potassium based. The most common alkaline liquid used in geopolymerisation is a combination of sodium hydroxide (NaOH) or potassium hydroxide (KOH) and sodium silicate or potassium silicate.

II. MATERIALS

a. Fly Ash

Fly ash is the most abundantly used mineral admixture as replacement for cement in mortar. It is

also the main ingredient for geopolymer mortar due to its active participation in the geopolymerization process. Pozzolanic material exhibits cementitious properties when combined with calcium hydroxide. Fly ash is used as the pozzolana in many concrete applications. Fly ash is used as cement replacement.

b. Fine Aggregate

Locally obtained trichy river sand is used as the fine aggregate in the mortar mixes. The sieve analysis result indicates that the sand confirms to zone-II as per IS: 383- 1970.

c. Sodium Hydroxide

Generally, NaOH is available in market in pellets or flakes form with 96% to 98% purity where the cost of the product depends on the purity of the material. The solution of NaOH was formed by dissolving it in water based on the molarity required. It is recommended that the NaOH solution should be made 24 hours before casting and should be used with 36 hours of mixing the pellets with water as after that it is converted to semi-solid state.

d. Sodium Silicate

It is also known as water-glass which is available in the market in gel form. The ratio of SiO_2 and Na_2O in sodium silicate gel highly affects the strength of geopolymer mortar. Mainly it is seen that a ratio ranging from 1 to 1.5 gives a satisfactory result.

III. MIX PROPORTION AND EXPERIMENTAL INVESTIGATION

a. Geopolymer Mix Design

Sodium hydroxide concentration	=14 M
Na_2SiO_3 to NaOH ratio	=1:2.50
Mix ratio	=1:0.6:1
Alkaline activator to Fly ash ratio	=0.62
Curing type	=oven curing
Curing period (oven)	=24 hrs@72°c -75°c

Fig.1 Moulding of Paver block

b. Preparation of alkaline activator solution

A combination of sodium hydroxide solution and sodium silicate solution was used as alkaline activators for geo polymerization. To prepare sodium hydroxide solution of 14 molarity (14M), 400 g of sodium hydroxide flakes were dissolved in distilled water and made up to one liter. The ratio of sodium hydroxide to sodium silicate is 1:2.5. As the reaction will evolve hot fumes, it will take one day to the solution to cool down. So, the solution should be mixed with one day prior to casting.

c. Preparation on geopolymer concrete

The raw materials are taken in calculated amounts. Then first the fly ash is mixed with the fine aggregate (quarry dust). Then the mix is mixed with coarse aggregate (6mm chips). Then finally alkaline activator solution is mixed with addition to super plasticizer for workability and the geo polymer concrete is prepared and is ready for casting.

Then Geopolymer concrete is poured into the mould. The mould is zigzag in shape, for the calculation purpose we have considered it as cuboid. For each rubber moulds of size 240 mm × 120 mm × 80 mm are used. The time period taken for demoulding is 4 days then the specimens are kept in heat curing chamber for oven curing.

Fig.2 Compaction using Table Vibrator

d. Compression test

Then specimen is placed in the compression testing machine in the recommended manner. Now the specimen is subjected to compression load after which they will crack. The readings are noted.

Fig.3 finished Paver block

Fig.4 Compaction testing machine

IV. TEST RESULT

A. Result and discussion

Sample	Compressive strength	
	Conventional Paver Block	*Geo-Polymer Paver Block*
GPPB-1	34.78 N/mm^2	42.71 N/mm^2
GPPB-2	35.26 N/mm^2	41.67 N/mm^2
Average	35.02 N/mm^2	42.19 N/mm^2

Cost analysis	
Conventional Paver block	*Geo-polymer Paver block*
Rs. 19.50	Rs. 31

The basic properties of materials were tested and the results are tabulated .The specimens are cured using heat curing chamber .The compressive strength of conventional paver block is compared with our geopolymer paver block. Conventional paverblock has a compressive strength of 35.02 N/mm^2 while our geopolymer aver block has a compressive strength of 42.19N/mm^2.

As CO_2 is the major contributor for the green house effect we have eliminated CO_2 by eliminating cement from our concrete.

In future there may be a crisis for water , that is when geopolymer concrete will get into good effect.

B. Conclusion

The following conclusions are made from the experimental study

1) This paper presents brief details of geopolymer concrete using sustainable materials.
2) This geopolymer paver blocks completely eliminates the CO_2 emissions.
3) The cost of geopolymer paver block is higher than conventional paver block but it gives more strength when compared conventional paver block and it doesn't harm to nature.

Acknowledgment

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Strength Of Geopolymer Concrete By Using Mineral Admixtures: A Review

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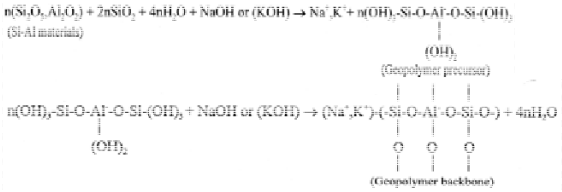
Abstract— Utilization of waste materials has been encouraged in construction field for the production of cement and concrete because it contributes to reducing the consumption of natural raw materials as resource and also reducing emission of greenhouse gases. All of these conditions have led researchers to look into alternative materials with high compressive strength that are also cheap and more environmentally friendly to use as building materials . Geopolymer is a promising alternative binding material to OPC which is a major contributor on the release of CO2 that causes global warming. Geopolymer has been proven to be environmental friendly and low energy consumptive material. It contains flyash, alkaline solution as binding material. Mineral admixtures are added to increase the strength and polymerization process. In this paper it concludes the strength and properties of geopolymer mixtures containing different mineral admixtures like GGBS, slag, rice husk, flyash, bentonite, alccofine, etc.

Keywords— ***Geopolymer concrete, Mineral admixtures, GGBS, slag, rice husk, flyash, bentonite, alccofine***

I.INTRODUCTION

A. GEOPOLYMER

Portland cement concrete industry has full-fledged universally in recent years.The demand for concrete as a construction material has enlarged due to enhance of infrastructure. However , production of Portland cement concrete generates problems such as carbon di oxide emission, global warming. Geopolymers are inorganic polymeric binding materials, developed by Joseph Davidovits in1970.Geopolymer is a type of amorphous alumino silicate cementations material that shows the ideal properties of rock forming minerals. Davidovits proposed that an alkaline liquid could be used to react with silicon and the aluminum in a source material of geological origin. Flyash geopolymers have been prepared as geopolymer pastes, mortar and the concretes. The source materials and the alkaline liquids are the two main constituents of geopolymer. The natural minerals that are rich in silicon and aluminium are the source materials for geopolymers. The alkaline liquid are from soluble alkali metals that are sodium or potassium based. The most common alkaline liquid used in geopolymerisation is a combination of sodium hydroxide and sodium silicate. When fly ash is introduce to concrete that hold portland cement, the mixture widens strength through a series of hydration reactions through which calcium silicate hydrate forms. Contact between portland cement grains and water initiates the reactions. Unlike portland cement hydration, geopolymerization may be described as a three-phase process that is commence by contact between an aluminosilicate material (such as fly ash) and an activate solution. These phases include dissolution, reorientation,and hardening process. Geopolymerization involves a diverse chemical reaction between aluminosilicate oxides and alkali silicate solutions at highly alkaline conditions and mild temperatures elastic three dimensional amorphous to semi-crystalline polymeric and ring structure, which dwell of Si–O–Al and Si–O–Si bonds.



The reaction path point out that Si-Al materials might become raw material for geopolymers. For the finest reaction, alkali activator (alkali solution and sodium silicate) and the favorable environment for retort are requisite. The main factors distressing geopolymerization are type and nature of raw materials, alkaline activators and curing conditions. Longer curing time improves the polymerisation process resulting in high compressive strength.Geopolymer cement concrete needs heat to gain strength

B. CONSTITUENTS OF GEOPOLYMER MIXTURES:

a. *Fly ash:* Fly ash is an industrial waste normally used to replace Portland cement for making mortar. Geopolymer is usually made of fly ash activated with alkaline solution at low temperature and it is sometimes called alkali-

activated flyash. Low calcium flyash is used for flyash based geopolymer mixtures.:

b. *Aggregates:* Fine and coarse aggregates are used in Geopolymer mixtures. Maximum size of fine aggregates used are less than 4.75 mm . It constitutes 75-80 % of the mass of GPC and the aggregate are in saturated surface dry condition. .

c. *Alkaline solution:* Alkaline solution comprises mixture of sodium hydroxide solution and sodium silicate solution at room temperature. Sodium hydroxide is available in flakes with purity of 97%- 98% purity. According to essential concentration sodium hydroxide is dissolved in water to make solution.It liberates large amount of heat so it is recommended to leave it for about 24 hours. Sodium silicate, (Na_2SiO_3), known as water glass or liquid glass, is commercially available in liquid form.

d. *superplasticizer:*To advance the workability of fresh concrete, high-range water-reducing naphthalene based super plasticizer was added to the mixture. The dosage of super plasticizer also has an effect on the compressive strength of the concrete.

e. *Water*:Portable water is used for mixing. The water content in Geopolymer concrete is the combined water present in the alkaline solution.

C. Effect of curing:

Curing plays an important role in strength of geopolymer .Strength of geopolymer concrete mainly depends on the temperature of curing and corresponding curing hours. The parameters such as curing time and curing temperature significantly affect the compressive strength of the hardened geopolymer concrete. As the curing temperature increases, the setting time of concrete decreases . During curing process, the geopolymer concrete experience polymerization process. Due to the increasing of temperature, polymerization become more rapid and the concrete can gain 70% of its strength within 3 to 4 hours of curing .

D. Advantages

- Cutting the world's carbon
- The cost of fly ash is stumpy
- High compressive strength
- Fire resistant
- stumpy permeability
- Eco friendly
- Excellent properties within both acid and salt environments.

E. Applications

The wide applications for bridges, such as precast structural elements and decks as well as structural retrofits using geopolymer-fiber composites. Geopolymer technology is most advanced in precast applications due relative ease in handling sensitive materials (e.g., high-alkali activating solutions) and the necessitate for a controlled high-temperature curing environment essential for many current geopolymer systems. To date, none of these potential applications has advanced beyond the development stage, but the durability attributes of geopolymers make them attractive for use in high-cost, severe-enviroment applications such as bridges. Other potential near-term applications are precast pavers and slabs for paving

F. Limitations

Even though several geopolymer systems have been projected ,most are complicated to work with and necessitate great care in their fabrication. In addition, there is a safety risk related with the high alkalinity of the activating solution, and high alkalinity also have need of more processing, ensuing in increased energy utilization and greenhouse gas generation. Additionally, the polymerization reaction is very sensitive to temperatureand usually have need of the geopolymer concrete be cured at elevated temperature under a strictly controlled temperature system . In many respects, these facts may bound the practical use of geopolymer concrete in the shipping infrastructure to precast application. Significant research is in progress to develop geopolymer systems that address these technical hurdle, create a low personified energy, low carbon dioxide binder that has alike property to portland cement. Additionally current research is focusing on the growth of user-friendly geopolymers that do not require the use of highly caustic activating solutions.

- geopolymer concrete requires special handling needs and is extremely difficult to create. It requires the use of chemicals, such as sodium hydroxide, that can be harmful to humans.
- While the idea of geopolymer concrete seems ultimate and could be the best thing to come along since Portland concrete, there are still too many unsound issues that can basis major hiccups in the mixing and application process of the concrete.

II. LITERATURE SURVEY

Mr. Bennet Jose Mathew *et.al,* intended to studyStrength, Economic and Sustainability Characteristics of Coal Ash –GGBS Based Geopolymer Concrete. A combination of 15 molar sodium hydroxide and sodium silicate in the ratio of 2.33 was used. M55 grade OPC concrete (CM). Fly ash - GGBS and bottom ash - GGBS based geopolymer concrete mixes are manufactured separately. in addition mixes were set by replacing fly ash with bottom ash in 10%, 20% and 30% replacement levels (by weight). 100mm cube

specimens of each geopolymer concrete mix are cured at elevated temperature at 60oC for 6 hours and then at 100oC for 3 hours. Another set of specimens of each mixes are cured by air curing for 28 days. OPC based concrete is cured in both elevated and ambient temperature by respective standard practices. The strength of concrete specimens and effect of replacement on the strength of fly ash–GGBS based geopolymer concrete is discussed along with cost and environmental impact analysis.It is observed that Curing at elevated and ambient temperature will form fly ash-GGBS based concrete of comparable strengths.Bottom ash –GGBS based geopolymer concrete gives very low strength possibly due to large particle size. Geopolymer concrete can be prepared at comparable cost with OPC based concrete provided transportation system for raw materials is well traditional. The embodied energy of fly ash- GGBS based geopolymer concrete is 40 % less than that of OPC based concrete. Sodium hydroxide (39%) and sodium silicate (49%) together contributes a lion's share to in material form energy of geopolymer concrete while in OPC cement contributes nearly 94% of the total embodied energy.

RohitZende *et.al,* studied On Fly Ash and GGBS Based Geopolymer Concrete under Ambient Curing Condition.Fly ash is replaced by GGBS in proportions of 25%, 50% and 75% to enhance various properties of concrete. The mix design is carried out for 11M and 13M concentration of sodium hydroxide. Alkaline activator solution ratio of 2.5 and alkaline liquid to fly ash ratio 0.40 is selected for this investigation. The specimen of size 150x150x150mm cubes, 150x300mm cylinders and 500x100x100mm prisms were casted and the specimens of geo-polymer concrete are cured at ambient temperature for 7days and 28 days. The cured specimens were then tested for compressive strength, split tensile strength and flexural strength respectively. Cement can be replaced by using fly ash, GGBS in the preparation of geopolymer. It helps in reducing carbon dioxide emission. It is observed that increase in GGBS content reduces the setting time and increases the degree of workability. The increase in slag content in the geopolymer concrete, increases in compressive strength, split tensile strength and flexural Strength. Nearly 80% of the strength is achieved in 7days at ambient curing. Maximum strength is obtained at slag replacement of 75% and the strength is increased as molarity increases.

Prasanna Venkatesan Ramani *et.al,* experimentally studied on the strength and durability properties of geopolymer concrete prepared using the ground granulated blast furnace slag and black ricehusk ash. The geopolymer concrete was initially prepared with ground granulated blast furnace slag as the primary binder instead of cement,and then blast furnace slag was replaced with black rice husk ash. The GGBS was kept as the base material in which the Black Rice Husk Ash was added in different percentages, and its effects on the compressive, flexural and tensile strengths, and durability properties, like Rapid chloridepermeability and resistance to accelerated corrosion, were studied. The strength results show that an optimum proportion of BRHA that can be used in geopolymer concrete is 20 %,considering the target strength of 30 MPa. It can be seen from the durability studies that the geopolymer concrete performed remarkably well with regard to chloride penetration and corrosion resistance for up to 20 % BRHA replacement.These results are very important for the development of such innovative concretes, in which the use of OPC is completely omitted. It promotes the utilization of alternate materials like GGBS and BRHA for binder production. Since these materialsare essentially industrial by-products, it also means a solution. It is possible to produce geopolymer concrete of substantial strength and durability using GGBS and BRHA to their disposal problem.

V. Supraja *et.al,* experimentally studied on Geo-Polymer concrete incorporating GGBS. Different molarities of sodium hydroxide solution i.e. 3M, 5M, and 7M and 9M are taken to prepare different mixes .Thecube specimens are in use of size 100mm x 100mm x 100mm.Two different curing conditions are carried that is oven curing at 500^0c and curing directly by placing the specimens to direct sunlight. The geo-polymer concrete specimens are tested for their compressive strength .For oven curing, the cubes are placed inan oven at 600 c for an hour. Then the cubes are demouldedand kept in oven at 500^0 C for 3 days and 7 days. For the sun light curing, the cubes are demoulded after 1 day of casting and they are placed in the direct sun light for 3 days and 7 days. From results, it is observed that the compressive strength is increased with the increase in the molarity of sodium hydroxide. After 3 days of curing the increase in the compressive strength is not significant. oven cured specimens gives the higher compressive strength but sun light curing is convenient for practical conditions.

A. Allahverdi *et.al,* investigated the geopolymerization of construction waste materials with different alkali-activators based on combinations of $Na_2SiO_3$and NaOH. Waste brick and concrete were used as rawmaterials. The proportion of the waste concrete waslimited to the maximum amount of 60% (byweight), The sodium oxide contents of the designed geopolymer cement mixes were attuned at threedifferent levels of 6, 7, and 8% (by weight of dry binder). The water-to-dry binder ratios (W/DBratios) were adjusted at four different values of 0.26, 0.27, 0.28 and 0.30, for an

approximately the same consistency. Laboratory techniques of Fourier Transform Infrared Spectroscopy (FTIR) and Scanning Electron Microscopy (SEM) were utilized for studying molecular and microstructure of the materials. Results obtained for 28-day compressivestrength confirm that waste brick is more suitablethan waste concrete for geopolymerizationreactions.The maximum achievable 28-day compressivestrength is 40 MPa for system comprising of only waste brick and containing 8% Na_2O by weight of dry binder.

Shankar H. Sanni, ***et.al,*** investigated on performance of geopolymer concrete subjected to severe environmental conditions. The grades choosen for the investigation were M-30, M-40, M-50 and M-60, the mixes were intended for molarity of 8M and 12M. The alkaline solution used with the ratio of 2.50 and 3.50.The test specimens were size of 150x150x150 mm cubes, 100x200 mm cylinders heat-cured at 60°C in oven. Durability of specimens were assessed by immersing GPC specimens in 10% sulphuric acid and 10% magnesium sulphate solutions individually, at times monitoring surface corrosion and depth of dealkalization, changes in weight and strength over a phase of 15, 30 and 45 days. The results revealed fly ash based GPC specimens prepared with different alkali content showed varying degree of corrosion when showing to sulphuric acid. Specimens received white deposits on the surfaces for the duration of contact to magnesium sulphate solution which gradually more distorted from soft and flaky shape to hard and rounded shape. GPC and PPCC mixes showed minor changes in weight and strength when the specimens were showing to sulphuric acid and magnesium sulphate. GPC do not have Portland cement, they can be considered as less energy intensive, since Portland cement is highly intensive energy material next only to Steel and Aluminium. GPC utilises the industrial waste for producing the binding material in concrete, hence it can be considered as eco-friendly material.

Bharat Bhushan Jindal *et.al,* carried out research on fly ash based geopolymer concretes with different percentages of alccofine and cured at ambient as well as heat environment in an electric oven at 90°C and the effects of percentage of alccofine, curing temperature, a period of curing, fly ash content, was studied on compressive strength as well as workability of geopolymer concrete. . The concentration of NaOH solution was 16 M so as to achieve better compressive strength . 2% Naphthalene Sulphonate based superplasticizer was used to improve the workability of fresh geopolymer mix.The mix design of geopolymer concretes with fly ash was done in reference tothe proposed design mix for the different proportion of fly ash. Similar to that of conventional concrete, coarse and fine aggregates were taken approximately 75-77% by mass of the entire mixture Higher W/GPS ratio improves the workability but reduces the compressive strength. Therefore, a fixed W/GPS ratio of 0.27 was used toachieve higher compressive strength. Alkaline liquid to fly ash (AL/FA) ratio was kept 0.38, 0.42 and 0.46 respectively for mix designated fly ash content 350 kg, 370 kg and 400 kg per meter cubic of geopolymer mix. GPC mixes with different amount of Alccofine 1203 (0%, 5%, and 10%) were also made to analyze its effect on workability and compressive strength of geopolymer concrete. Based on the results it is concluded that Unprocessed fly ash doesn't gain any desirable mechanical properties.The presence of alccofine produces better workable concrete with processed and unprocessed fly ash geopolymer concrete.Minimum required compressive strength for general construction purpose can be achieved with alccofine even at room temperature. The increase in compressive strength is significant at 900C in the presence ofalccofine and perhaps provides an opportunity for the most economical and sustainable way to achieve higher compressive strength. XRD study points out that on the addition of alccofine, amorphous material changes into the crystalline material which is responsible for the improved compressive strength of GPC.

PradipNath. Prabir Kumar sarker *et.al,* aimed to achieve fly ash-based geopolymers suitable for curing without elevated heat (21 - 23°c). Geopolymer concrete and mortar mixtures were proportioned with different mix variables which include the amount of GGBFS in replacement of fly ash, as 10%, 20% and 30% of total binder respectively. Varying ratio of sodium silicate to sodium hydroxide (SS/SH) as 1.5 and 2.0 respectively.Slump and flow test was conducted immediately after mixing. Compressive strength test was conducted at 3, 7, 28 and 56 days. The test was conducted in a temperature of 21–23°c. Adding of GGBFS in the fly ash based geopolymer mixture reduces the workability and setting time, Slump of concrete and flow of mortar decreased with the enhance of slag. Fly ash based geopolymer modified with GGBFS is found to be a suitable binder for low to moderate strength concrete production at ambient curing condition, as it eliminates the necessity of heat curing. Among the mixtures of this study, the mixtures having 10% slag, 40% alkaline activator and SS/SH ratio 1.5–2.5 with no extra water can be considered as the optimum mixture for reasonable compressive strength in ambient curing condition.

Shweta Mane *et.al,* studied on the effect of elevated temperatures on geopolymer mortar and concrete for different types of coarse and fine aggregates, also they are compared with the OPC concrete of M20 grade. Coarse aggregates used for concrete specimens are basalt and granite

aggregates while natural river sand and crushed sand are used as fine aggregates for mortar specimens. OPC and Geopolymer specimens were tested for compressive strength .After that the specimens were subjected to elevated temperatures 40ºC, 100ºC, 200ºC geopolymer mortar has better compressive strength (81% more for natural sand and 89% more for crushed sand) than the general OPC mortar. The fly ash-based Geopolymer concrete shows good fire resistance and shows less reduction in compressive strength than the general OPC concrete, without causing spalling. In both the cases, OPC and GPC concrete, granite aggregates show more (5.63% more) strength than the basalt aggregates. For mortar, crushed sand show better performance (10.49% more strength) than the natural river sand. Geopolymer produces a substance that is comparable to or better than traditional cements. Low-calcium fly ash-based geopolymer concrete offers several economic benefits over Portland cement concrete as the cost of one ton of fly ash is only a small fraction of the cost of one ton of Portland cement., 300ºC, 400ºC and 500ºC. Fly ash based geopolymer concrete has excellent compressive strength (68% more for basalt aggregates and 67% more for granite aggregates) than the general OPC concrete and is suitable for structural applications.

Mohammed Haloob Al-Majidi *et.al,* experimentally investigated on the mechanical and micro structural properties of geopolymer concrete mixes using fly ash and GGBS .Fly ash based Geopolymer concrete requires high temperature curing treatment in order to develop early strength properties which is considered as a limitation for cast in place concrete applications. Fresh geopolymer mortar properties were examined through workability, and setting time, mechanical performance and physical and chemical characteristics of hardened mortar were evaluated by compressive strength tests, direct tensile tests, flexural strength tests, SEM-EDS, porosity, and FTIR analysis and thermal heating. From results, it is revealed that increasing in GGBS content in the flyash based geopolymer mortar decreases the workability and increases the setting time and hardening in fresh geopolymer mortar. In hardened geopolymer mortar increasing in GGBS increases the compressive strength and reduces porosity. Geopolymer mixes with increased GGBS content had considerably improved flexural and direct tensile strength, without any heat curing treatment which makes the proposed method suitable for in situ applications.

III. CONCLUSION

From the past research studies, it can be sequel that:

1. Geopolymer concrete can be prepared at comparable cost with OPC based concrete provided transportation system for raw materials is well traditional.
2. Increase in GGBS content reduces the setting time and increases the degree of workability. The increase in slag content in the geopolymer concrete, increases in compressive strength, split tensile strength and flexural Strength
3. As the molarity increases, Strength is also increased. Different mineral admixtures like GGBS, slag, rice husk, bentonite, alccofine can be partially replaced for flyash.
4. Oven cured specimens gives the higher compressive strength but sun light curing is convenient for practical conditions.
5. GPC utilises the industrial waste for producing the binding material in concrete, hence it can be considered as eco-friendly material.

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Mechanical Properties Of Fiber Reinforced High Performance Cocrete Using Marine Sand

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Abstract—This paper generalized the result of study on Marine sand based High performance concrete The Land Reclamation and Development Board (Sri Lanka) plans to popularize the use of sea sand as a substitute to river sand. According to the experts in the global construction trade, Sea sand is being used in the construction industry in the Asian Region and some leading European countries. This study is to experiment the suitability to use sea sand as a substitute for river sand as fine aggregate for concrete. The attempt has been made to find the various results by using sea sand and polypropylene fiber with normal concrete of M_{60} grade with maintaining the water cement ratio of 0.32. The objective of this study is to develop concrete with good strength and durability will be reached. For this purpose, the experiment is carried out on M_{60} grade of concrete using marine sand, different percentages (0%, 0.5%, 1%, 1.5% and 2%) of polypropylene fiber to the weight of cement. Super plasticizer Conplast SP430 was used to maintain workability with constant Water-cement ratio. Strength properties was determined such as compressive, split tensile and flexural strength test. This is done to determine the efficiency and optimum percentage of replacement at which maximum strength is achieved. Higher grade concrete is produced by adding polypropylene fiber.

Keywords— Durability, High Performance Concrete, Marine Sand, Polypropylene fiber, Strength.

I. INTRODUCTION

The boom in the construction sector is a direct result of economic growth. This fast growth leads to severe competition for resource rights of fine aggregate and coarse aggregate from riverbeds. This results in unlawful mining of river beds for river sand which in turn causes environmental problems. Due to this scarcity of river sand, the contractors are mixing sea sand with river sand.

Over-exploitation of river sand to meet the demand has led to various harmful consequences such as increase in the depth of the river bed, lowering of the water table, and salinity interference into the rivers. Because of these environmental problems, there is a necessity to restrict river sand mining especially at vulnerable locations. As a remedial measure, the government imposes various restrictions on the mining of river sand with consequent increases in prices. Not only has this inconvenienced the users directly, but also indirectly impacted on the overall stability of the construction industry owing to related increases in construction prices

This study is a basic practical study on the compressive strength of concrete made by using sea sand as a replacement to fine aggregate. In this the fine aggregate was replaced completely by sea sand.

II. MATERIALS

Experimental program has been designed to provide sufficient information for ascertaining the quality of Sea sand based reinforced High Performance concrete. To evaluate the behavior of sea sand based reinforced High Performance concrete, both mechanical strength and durability aspects have been studied in this investigation.

A. Cement

Ordinary Portland cement-53 grade have used in examination. The cement was tested according to IS 4031:1988. It confirmed to IS 12269:1987. Its Properties is given in Table 2.1.

B. Fine Aggregate

The fine aggregate used in the experimental investigation was natural Sea sand confirming to Zone IV of IS 383-1987. Sand used in the work which has particle size less than 4.75 mm

.

C. Coarse Aggregate

Crushed granite aggregate particles passing through 12.5mm and retained on 10mm I.S sieve used as the natural aggregate which met the grading requirement of IS 383-1970.

D. Polypropylene Fiber

Polypropylene fibers can improve the compressive strength, tensile strength and flexural strength of concrete. It is also enhance the durability properties of concrete. The Recron 3S Polypropylene fibres are used in this study. The aspect ratio is 12. The shape of the fibre helps in better bonding with the concrete.

E. Super Plasticizer

Generally super plasticizers are used to improve the workability and reduce water content. According to this the super plasticizer Conplast SP 430 is a high range water reducing agent. There are difficulties and limitations to obtain high workability in the field for a given set of condition. Specific gravity and Chloride content of super plasticizer are 1.220 to 1.225 at 300ºC and Nil as per IS: 456 respectively.

The test data determined from the materials are as follows,

Table 2.1: Properties of Materials used

S.no	Name of the material	Properties of material	Result	
1	OPC 53 grade	Specific gravity	3.13	
		Fineness modulus	3.6%	
		Consistency	32%	
		Initial setting time	30 min	
		Final setting time	10 hrs	
2	Fine aggregate	Comparison	River sand	Marine sand
		Specific gravity	2.54	2.73
		Fineness modulus	4.83	3.46
		Bulk density	1782.46kg/ m^3	1700.12kg/ m^3
3	Coarse aggregate	Specific gravity	2.63	
		Water absorption	0.56%	
		Fineness modulus	84	
		Bulk density	1915.2kg/m^3	
		Impact test	15%	
4	Chloride content test	Washed sea sand	45 ppm	
		Unwashed sea sand	170 ppm	

III. MIX PROPORTION

The very first step to assure the workability requirement of HPC is to determine the optimum dosage of calcium nitrate and super plasticizer. Various mixes were prepared and tested to satisfy the ACI 211.4R-08 guidelines. Finally a mix is chosen which gave fulfilling fresh properties. The addition of different percentage of Polypropylene would be done in this mix. The optimum dosage of Polypropylene fiber is 2% and 1% of super plasticizer added to each mix.

The mix proportion was done based on the ACI 211.4R-08. The mix design was carried out for M60 normal grade of High Performance concrete with the addition of Polypropylene fiber.

Mix Ratio

WATER	CEMENT	FINE AGGREGATE	COARSE AGGREGATE
501.19 l/m^3	155.37 kg/m^3	616.98 kg/m^3	1302 kg/m^3
1	0.32	1.23	2.59

Sea sand (SS) is used as the fine aggregate, polypropylene fiber (PF) is varied from 0.5%-2% and superplastizier (SP) are kept in constant of 3.5% and 1% respectively

Combinations of mixes

Specimen	Explanation
MIX RS	Conventional mix using river sand + 1% SP
MIX SS	Conventional mix using sea sand + 1% SP
MIX 1	Concrete mix using SS + 0.5% PF + 1% SP
MIX 2	SS + 1% PF + 1%SP
MIX 3	SS + 1.5% PF + 1%SP
MIX 4	SS + 2% PF + 1%SP

IV. EXPERIMENTAL WORKS

A Slump test

Workability is defined as the ability or case with which the concrete is handled, transported and placed in the form with minimum loss of homogeneity. In the present study, workability was determined using slump cone test for the concrete using sea sand. The slump test was performed as per IS 1199- 1959, the slump test is the most well-known and widely used test to characterize the workability of fresh concrete.

B Mechanical properties

All the mixes were tested for various hardened properties like compressive strength, flexural strength & Split Tensile Strength test as per Indian Standards. The six different combination mixes were prepared including conventional for testing. In this investigations, Specimens prepared such as cube size is 150X150X150 mm, cylinder size is 300X150 mm and prism (500X100X100 mm) for each combinations. The testing was done on specimens after 28 days curing. All tests was repeated for three specimens and average value was taken as the mechanical strength.

1. *Compressive Strength*

In this investigation, the cube specimen of size 150mm x 150mm x 150mm were cast, cured and tested in accordance with BIS: 516 – 1959 (method of test for test of concrete). The testing was done on compressive testing machine of 2000kN capacity.

2. *Split Tensile Strength*

The objective of this is to find the splitting tensile strength of the concrete cylinders. This cones under indirect tension test methods. A concrete cylinder of size 150mm diameter and 300mm height was subjected to the action of the compressive forces along two opposite edges. The test was conducted using compressive testing of 200kN capacity.

Horizontal Tensile Stress = $2P/\pi DL$

Where, P = Compressive load on the cylinder.

L = Length of cylinder.

D = Diameter of cylinder.

3. *Flexural Strength*

Flexural tests were conducted on beams of size of 100 mm x 100mm X 500 mm subjected to two point loading at 28 days in UTM. The maximum load applied to the specimen shall be recorded and the flexural strength of concrete expressed as the modulus of rupture (f_b) is calculated.

Modulus of rupture $f_b = 3Pl / 2bd^2$

V. RESULT AND DISCUSSION

1. Slump Value

Table-5.1: Slump values of HPC mixes with river and sea sand

MIX ID	Slump value in mm
MIX RS	70
MIX SS	62
MIX 1	58
MIX 2	56
MIX 3	49
MIX 4	31

2. Compressive and Split Tensile Strength

The Compressive and Split Tensile Strength of High Performance Concrete with various percentage of Polypropylene fiber. These results are given in table.

Table-5.2: Influence of River sand and Sea sand on Compressive and Split tensile strength of HPC

Concrete label	Compressive Strength (MPa)		Split Tensile Strength (MPa)	
	7 days	28 days	7 days	28 days
MIX RS	30.5	64.03	2.91	4.38
MIX SS	29.67	60.68	2.57	4.00
MIX 1	35.25	63.73	3.97	5.72
MIX 2	38.22	64.05	3.45	5.20
MIX 3	33.56	61.39	3.21	4.81
MIX 4	28.51	58.34	2.50	3.71

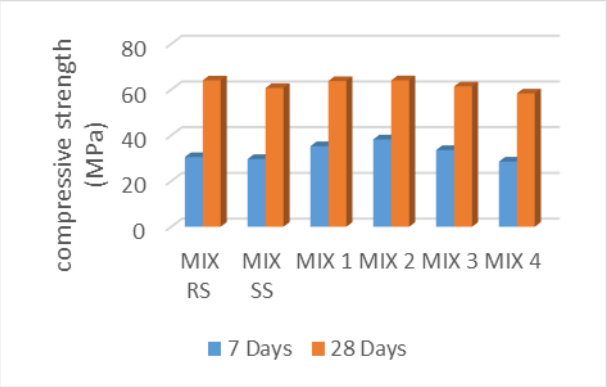

Fig-5.1: Influence of Sea sand on Compressive strength of Concrete

From the test results, the compressive strength obtained for the MIX RS 28 days is greater than the MIX SS. The compressive strength for 1% of polypropylene fiber (64.05MPa) is higher than the control mix (MIX SS). The result show that for all ages, the polypropylene fiber ranging from 0.5%, 1% and 1.5% yields higher compressive strength when compared to conventional concrete mix. Beyond that there is a decrease in strength for addition 2% of polypropylene fiber.

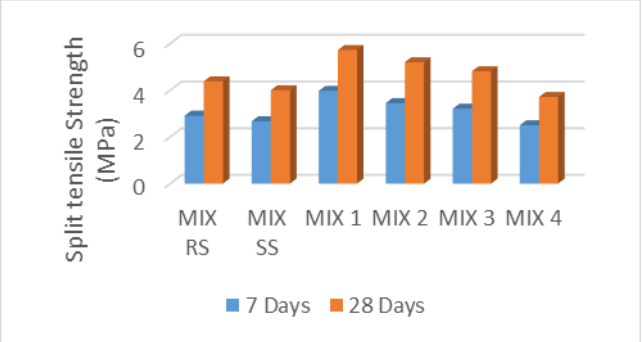

Fig-5.2: Split tensile strength of sea sand based concrete

From the test results, the Split Tensile strength obtained for the MIX RS 28 days is greater than the MIX SS. The Split tensile strength for 0.5% of polypropylene fiber (5.72MPa) is higher than the control mix (MIX SS). The result show that for all ages, the polypropylene fiber ranging from 0.5%, 1% and 1.5% yields higher tensile strength when compared to conventional concrete mix. Beyond that there is a decrease in strength for addition 2% of polypropylene fiber.

3. Flexural Strength

The flexural Strength of High Performance Concrete with various percentage of Polypropylene fiber. These results are given in table.

Table-5.3: Flexural strength of HPC

S.No	Combination	Flexural strength of concrete N/mm2 28 DAYS
1	MIX SS	5.865
2	MIX 1	6.425
3	MIX 2	6.515
4	MIX 3	5.825
5	MIX 4	4.035

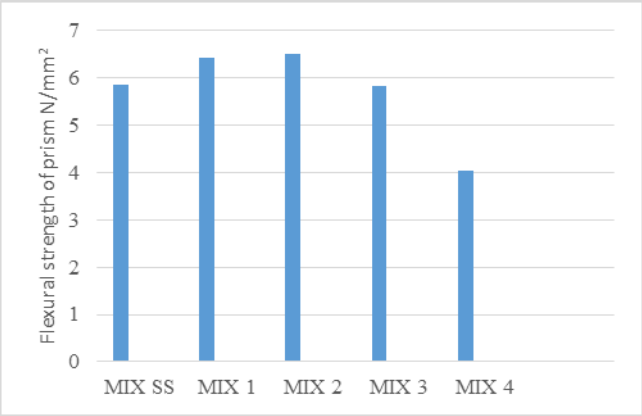

Fig-5.3: Flexural strength of River sand based HPC

From the test results, the Split Flexural strength obtained for the MIX 1, 28 days is greater than the MIX SS (nominal). The Split flexural strength for 1% of polypropylene fiber (6.425 MPa) is higher than the all the replacement mixes also control mix (MIX SS). The result show that for all ages, the polypropylene fiber ranging from 0.5% and 1% yields higher tensile strength when compared to conventional concrete mix. Beyond that there is a decrease in strength for 1.5% and 2% of polypropylene fiber.

VI. CONCLUSION

The following conclusions are drawn for feasibility study conducted on reinforced High Performance compacting concrete with Polypropylene fiber as includes,

The conclusion based on the limited observations from the present investigation on study of compressive, split tensile strength and flexural strength of the concrete made using sea sand as fine aggregate as a replacement of river sand by using polypropylene fiber (0% to 2%) and super plasticizer (1%). The addition of polypropylene fiber ranging from 0.5%, 1%, and 1.5% yields higher compressive strength than the conventional concrete mix. Beyond that there is a decrease in the compressive strength of concrete by adding 2% of polypropylene fiber.

- Sea sand based HPC has 5.5% lower compressive strength when compared to its counterpart mix made of river sand
- The addition of polypropylene fiber and calcium nitrate increases the compressive strength and split tensile strength containing sea sand as a fine aggregate.
- The addition of polypropylene fiber by 1% and sea sand as a fine aggregate had shown 5.5% increase in compressive strength and at 0.5% of polypropylene fiber 42.5% increase in compressive strength when compared to the conventional concrete mix (MIX SS)
- Compressive strength, split tensile strength and flexural strength variation for the addition of polypropylene fiber indicate as an optimum replacement level. The observed maximum strength in compression, tension and flexural was 64.05MPa, 5.72MPa and 6.515MPa respectively at 28 days.
- The addition of alccofine in SCC improves microstructure of concrete that also helpful to enhance all mechanical properties of concrete.

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STUDY ON COMPRESSIVE STRENGTH OF HIGH PERFOMANCE CONCRETE USING VARIOUS PROPOTIONS OF METAKAOLIN

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Abstract- Due to the growth of construction industry and major infrastructure project , there is a huge demand for cement as a building material and It also creates environmental problems ,some of them being increasing of CO2 and results emission of heat .Then there should be higher strength is to provided .The attempt has been made to compare, the 7days and 28 days compressive strength of concrete by using metakaolin with the normal concrete of M60 grade with maintaining water cement ratio.The objective of this study is to develop concrete with good strength.Thus the cement can be replaced by metakaolin which is artificial clay .That varying percentage of metakaolin is added as 5%,10%,15% to the concrete mixture in order to improve the performance of concrete. Blending these materials with ordinary Portland cement can improve the cementing and mechanical properties of cement .These days use of metakaolin is tremendously gaining popularity in partial replacement of cement due to its fineness in improving strength and parameters of mortars and concrete.

Keywords: Metakaolin,concrete,compressive strength.

1.INTRODUCTION

Concrete is basically a mixture of cement, fine and coarse aggregates. Concrete is an extraordinary and key structural material in human history. Concrete holds the credit of being the most widely utilized tailored or man-made material in the construction industry and will hold good for the years to come. High performance concrete is a concrete mixture, which possess high durability and high strength when compared to conventional concrete. This concrete contains one or more of cementious materials such as fly ash, Silica fume or ground granulated blast furnace slag and usually a super plasticizer. The term 'high performance' is somewhat pretentious because the essential feature of this concrete is that it's ingredients and proportions are specifically chosen so as to have particularly appropriate properties for the expected use of the structure such as high strength and low permeability. Metakaolin is a dehydroxylated form of the clay mineral kaolinite . stone that are rich in kaolinite are known as china clay or kaolin , tradionally used in the manufacture of porcelain.Considered to have twice the reactivity of most other pozzolans , metakaolin is a valuable admixture for concrete cement applications. Considered to have twice the reactivity of most other pozzolans , metakaolin is a valuable admixture for concrete cement applications . Replacing Portland cement with 8-20% (by weight) metakaolin produces a concrete mix , which exhibits favourbale engineering properties , including the filler effect , the acceleration of OPC hydration ,and the pozzolanic reaction occurs between 3and 14days

2.METHODS AND MATERIAL PROPERTIES

2.1Methodology:

Mix design of M60 concrete was done with various propotions of metakaolin. The curing was done for 7and 28 days , after the hardened tests of compressive ,flexural and tensile were made on specimen for the strength test**.**

2.2MATERIAL PROPERTIES

2.2.1Metakaolin

Metakaolin is a dehydroxylated form of the clay mineral kaolinite . stone that are rich in kaolinite are known as china clay or kaolin , tradionally used in the manufacture of porcelain. The particle size of metakaolin is smaller than of cement particles ,but not as fine as silica fume

The quality and reactivity of metakaolin is strongly dependent of the characteristics of the raw material used . Metakaolin can be produced from a variety of primary and secondary sources containing kaolinite

The T-O clay mineral kaolinite does not contain interlayer water. The temperature of dehydroxylation depends on the structural layer stacking order. Disordered kaolinite dehydroxylates between 530 and 570º , ordered kaolinite between 570 and 630ºC . Dehydroxylated disordered kaolinite shows higher pozzolanic activity than ordered

The adsorption surface properties of the metakaolins can be accomplished by inverse gas chromatography analysis

Considered to have twice the reactivity of most other pozzolans , metakaolin is a valuable admixture for concrete cement applications . Replacing Portland cement with 8-20% (by weight) metakaolin produces a concrete mix , which exhibits favourbale engineering properties , including the filler effect , the acceleration of OPC hydration ,and the pozzolanic reaction occurs between 3and 14days

Chemical composition	Metakaolin (%)
Silica (Sio_2)	54.3
Alumina (Al_2o_3)	38.3
Ferric oxide(Fe2o3)	4.28
Calcium oxide(Cao)	0.39
Magnesium oxide(Mgo)	0.08
Sodium oxide(Na_2o)	0.12
Potassium oxide(K_2o)	0.50
Sulphuric anhydride(So_3)	0.22
Loss on ignition(LOI)	0.68
Blaine (m^2/kg)	150000
Specific gravity	2.5

3.LITERATURE SURVEY

An extensive review was carried out to study the design of high performance concrete with metakaolin . The review also focuses on the strength and durability aspects of using HPC. Though there are a number of research papers available or lower grade of concrete using metakaoine only a limited number of publication are available on the HPC using metakaolin and structural behavior of reinforced concrete. The literatures pertaining to this topic are given below in brief

Prof. R.M. Sawant, Dr. Y.M. Ghugal-Volume - 4,Issue-12,pp- 08-14[1].Due to worldwide infrastructural development, since 20th century use of concrete has tremendously increased which resulted in heavy manufacturing of cement. Various types of pozzolonic materials viz.fly ash, silica fume, metakaolin, blast furnace slag etc. are available which has cementeous properties.Blending these materials with ordinary portland cement can improve the cementing and mechanical properties of cement.It can be concluded that the partial replacement of cement by metakaolin has a good influence on the strengths of the cement mortars and concrete. It increases strengths of all basic properties viz. compressive strengths, flexure strengths, split strengths, tensile strengths etc.

B. B. Patil, P. D. Kumbhar Volume-3 Issue-4 2009 March[2] Strength and Durability Properties of high performance concrete incorporating High Reactivity Metakaolin.Concrete is probably the most extensively used construction material in the world. The addition of mineral admixture in cement has dramatically increased along with the development of concrete industry, due to the consideration of cost saving, energy saving, environmental protection and conservation of resources. Mineral admixtures such as fly ash, rice husk ash, metakaolin, silica fume etc are more commonly used in the development of HPC mixes. The results of the study indicate that the workability and strength properties of HPC mixes improved by incorporating HRM up to a desirable content of 7.5% by weight of cement.

P.Dinakar,Pradosh K.Sahoo and G. Sriram Volume -4 Issue-2 2011[3] Effect of metakaolin content on the Properties of High Strength Concrete This study presents the effect of incorporating metakaolin (MK) on the mechanical and durability properties of high strength concrete for a constant water/binder ratio of 0.3.MKmixtures with cement replacement of 5, 10 and 15 %were designed for target strength and slump of 90 MPa and 100 ± 25 mm. From the results, it was observed that 10 % replacement level was the optimum level in terms of compressive strength. From the results, it was observed that 10 % replacement level was the optimum level in terms of compressive strength.The results shows that by utilizing local MK and cement designed for a low water/binder ratio of 0.3, high strength and high performance concretes can be developed and compressive strengths of more than 100MPa can be realized.

SanjayN.Patil1,AnilK.Gupta,SubhashS.DeshpandeVolume3,Issue7July2015[4]Metakaolin-pozzolanic material for cement in high strength concrete. The infrastructure development is an important aspect for the overall development of country. India is developing as a major hub for service industry, automobile industry and for which the infrastructure development plays an important role. The necessity of high strength concrete is increasing because of demands in the construction industry.

Shaikh Mohd Zubair1, S.S. Jamkar -2015 August[[5]Now a day's high performance concrete is

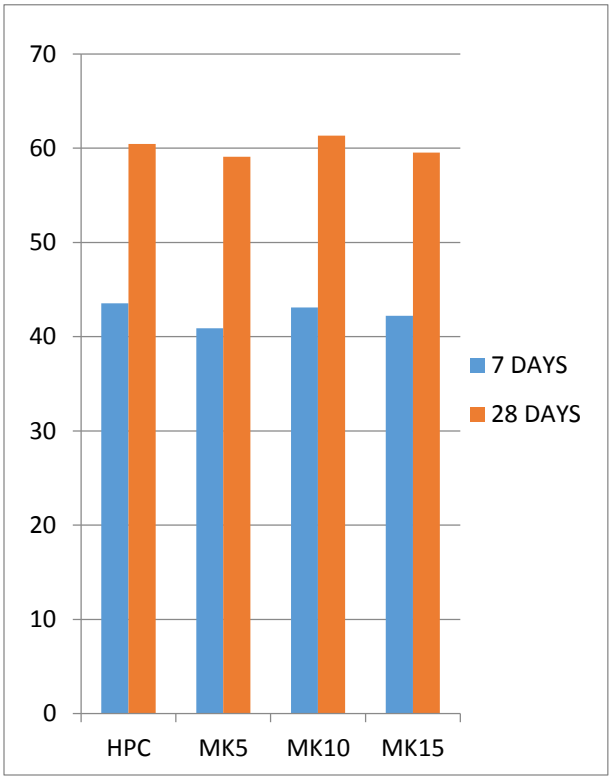
globally used in the infrastructure industry for strong and durable structure, to produced high performance concrete various supplementary cementitious material are used as mineral admixture. This research involves the use of Fly ash, Alccofine and Silica fume at various proportions to enhance the compressive strength of high performance concrete. the investigation was carried out by replacing 10% fly ash along with 17% of alccofine and 10% fly ash along with 17% of silica fume by weight of cementitious material. To cover a wide range of compressive strength of concrete various water binder ratio (W/b) of 0.25, 0.3 and 0.35 were used. The effect of various parameters such as percentage replacement of mineral admixture, water to binder ratio and corresponding compressive strength is studied on fresh and hardened state of concrete. The study mainly consisted of establishing relation between these parameters graphically. Investigation demonstrates that alcofine performs batter than that of silica fume along with fly ash in fresh and harden state

SudarsanaRao.Hunchate1,Sashidhar.Chandupalle2,Vaishali.G.Ghorpode3 and Venkata Reddy.T.C4 - 3, March 2014[6]High Performance Concrete (HPC) now a days used widely in the construction industry world wide. To produce HPC with normal ingradients we use mineral admixtures like Silica fume, fly ash and metakoline and workable agents Superplasticizers are also used. The usage of mineral admixtures in the concrete not only enhances its strength properties but also durability. The compressive strength are investigating finding the optimum use of mineral admixture(Silica fume of levels 0, 5, 10,15, 20 and 25% at 7 days and 28 days.

4.RESULT AND DISCUSSION

After testing the properties of fresh concrete mix on HPC, concrete cubes,cylinders, prisms were cast for studying the properties of hardened concrete .The following tests were carried out on hardened concrete of various HPC

S.NO	MIX	7Days	28Days
1	HPC	43.55	60.44
2	MK5	40.89	59.11
3	MK10	43.11	61.33
4	MK15	42.22	59.55



4.1Graphical representation of compressive strength

5.CONCLUSION

- It can be concluded that the partial replacement of cement by metakaolin has a good influence on the strength of the cement mortar.

- The mineral morpology of both cement and metakaolin being identical contributes as a better binding material.
- It can be derived by use of 8%to 12% metakaolin by weight of cement with metakaolin from 1to 3% by weight cement.
- Cement replacement upto 10% with metakaolin leads to increase in compressive strength ,splitting tensile strength and flexural strength for both M60 grade
- There is a decrease in workability as the replacement level increase and water consumption was more for higher replacement.
- Use of metakaolin gives significant result on properties of concrete as compared to normal concrete.

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Experimental Study On Geopolymer Concrete Under Daylight Curing

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Abstract— Geopolymer concrete is the developing alternative construction material by replacement of cement concrete, due to the environmental pollution cement is replaced by fly ash. Fly ash is the byproduct of thermal power plant industry. The study has been made of cement concrete and geopolymer concrete in different curing condition. In practical, heat curing is not suitable during construction and is uneconomical. To overcome these difficulties, the implementation of daylight curing is necessary. Mix proportion of cement concrete is under the guidelines of IS 10262-1982 using M25 grade concrete mix ratio cement: fine aggregate: coarse aggregate (1:1:2.70) and water cement ratio of 0.40. Geopolymer concrete mix proportion is under the "Modified guidelines for geopolymer concrete from the Bureau of Indian Standards" using 12M mix ratio fly ash: fine aggregate: coarse aggregate (1:1.54:3.43) and alkaline solution fly ash ratio of 0.55. Concrete cubes of size 150X150X150mm were prepared and cured under daylight curing. The compressive strength was founded out at 3,7,14,21,28 days. From the results, the geopolymer concrete attains the compressive strength without hydro-curing and also to achieve its target strength within 14 days of daylight curing.

Keywords—SCC, Alccofine, steel fiber, Rheological properties, Strength characteristics.

I.INTRODUCTION

Ordinary Portland Cement (OPC) becomes an important material in the invention of concrete which act as its binder to unite all the aggregate together. However, the utilization of cement causes pollution to the environment and decline of raw material (limestone). The manufacturing of OPC requires the flaming of large quantities of fuel and decomposition of limestone, resulting in considerable emissions of carbon dioxide As such, geopolymer concrete had been introduced to reduce the above problem. In1978, J.Davidovits initiated inorganic polymeric material that can be used to react with another source material to form a binder. The application of this binder is recently being focused to replace Ordinary Portland Cement (OPC) portion in concrete. The environmental issues resulted from OPC production has taken the progress of polymer researches further nowadays. The encouragement to produce the eco-friendly concrete can be achieved by limiting the utilization of raw materials and decreasing the rate of pollutant from respective OPC production, and diminishing the cement portion in concrete. Employment of waste material like fly ash, rice husk ash, and other cement alternate material (CRM) can only substitute cement portion until certain percentage. Geopolymer, named after the reaction between polymer and geological origin resource material, is proposed to replace all cement portions in concrete as the main binder. The main constituents of geopolymer are alkaline liquid and source material. Alkaline liquid is usually a combination of sodium hydroxide or potassium hydroxide with sodium silicate or potassium silicate. The use of only alkaline hydroxide activator will outcome in low rate reaction compared to those containing soluble silicate. The addition of sodium silicate solution to sodium hydroxide solution will enhance the reaction rate between alkaline liquid and source material. Source materials used in this research are combination of fly ash. This materials have specification for calcium content, which is low in calcium. High calcium content in source material is not recommended since it can obstruct the polymerization process. B.Vijaya Rangan [1] Studied the low-calcium fly ash-based geopolymer concrete and he concluded Low-calcium fly ash (ASTM Class F) is used as the source material, instead of the Portland cement, to make concrete. Low-calcium fly ash-based geopolymer concrete has admirable compressive strength and is suitable for structural applications. P.Nath and P.K.Sarker [2] have Conducted study on ''Geopolymer Concrete for ambient Curing Condition" and they concluded Inclusion of slag in the fly ash based gpc mixture decreased the setting time and increased the compressive strength. adding slag up to 30% of total binder achieved compressive strength upto 55MPa at 28 days. With increase of alkaline activator solution in the mix from 35% to 45% of total binder, the setting time increased and compressive strength decrease. Slump of fresh concrete also increased with the increase of alkaline

solution in the mixture. Djwantoro Hardjito *et.al* [3], Concluded the higher concentration (in terms of molar) sodium hydroxide solution results in the higher compressive strength of geopolymer concrete Higher the ratio of sodium- silicate- to – sodium hydroxide liquid ratio by mass, higher is the compressive strength of geopolymer concrete. N A Lioyd and B V Rangan [4], Conducted study on Geopolymer Concrete with Fly ash Geopolymer concrete results from the reaction of a source material that is rich in silica and alumina with alkaline liquid. A summary of the wide-ranging studies conducted on fly ash based geopolymer concrete is presented. The paper also includes brief details of some recent applications of geopolymer concrete. Based on the study they proposed mix proportion and method of curing of geopolymer concrete. It is concluded from the above study to study the effect on the rest period before daylight curing, Setting up of curing specimens applied to the geopolymer concrete. To observe the and hardened properties of fly ash-based geopolymer concrete, mainly its compressive strength. Longer curing time give higher compressive strength with 70°C.The compressive strength of the geopolymer concrete is increased with the increasing of concentration of NaOH.

II. MATERIALS AND MIX PROPORTIONS

a) Fly Ash

Fly ash consists of finely divided ashes produced by pulverized coal in thermal power stations. The chemical composition depends on the mineral composition of the coal gangue (the inorganic part of the coal). **The fly ash was obtained from Thermal Power Station Tamilnadu, India.** The properties of fly ash are given in table 1.

TABLE 1: Properties of flyash

S.No	*Properties*	*Results*
1.	Specific Gravity	2.82
2.	Fineness modulus	1.375
3.	Specific surface area	310 m^2/kg
4.	Density	1.4 kg/m^3

b) Aggregates

Local aggregates, comprising 20 mm, 14 mm and 7 mm coarse aggregates and fine aggregates, in saturated surface dry condition, were used. The coarse aggregates were crushed granite-type aggregates and the fine aggregate was fine sand. The properties of coarse aggregate are given in table 2.

TABLE 2: The properties of aggregates

Aggregates	Specific gravity	Fineness modulus
Coarse aggregate	2.96	6.00
Fine aggregate	2.36	2.80

c) Cement

Cement is a binder or a substance that sets and hardens and can bind other materials together. The specific gravity of cement is 3.14.

d) Alkaline liquid

The alkaline liquid used was a combination of sodium silicate solution and sodium hydroxide solution. The sodium silicate solution (Na2O= 13.7%, SiO2=29.4%, and water=55.9% by mass) was purchased from a local supplier in bulk. The sodium hydroxide (NaOH) in flakes or pellets from with 97%-98% purity was also purchased from a local supplier in bulk. The NaOH solids were dissolved in water to make the solution**.**

e) Super Plasticizer

A commercially available sulphonated naphthalene formaldehyde based super plasticizer (CONPLAST SP 430) was used as chemical admixture to enhance the workability of the concrete. Color: Brown; Type: liquid; Specific gravity: 1.22-1.225 @ 300˚C.

f) Mix Design For Geopolymer Concrete

According to modified guidelines of geopolymer mix proportion was arrived [5]. The geopolymer mix proportion becomes **1:1.54:3.43.**

TABLE 3: Mix proportion for gpc 12m

S.No	*Materials*	*Mass(kg/m^3)*
1.	Coarse aggregate	1276.8
2.	Fine aggrgate	547.20
3.	Flyash	371.6
4.	Sodium silicate solution	122.628
5.	Sodium Hydroxide solution	81.75
6.	Superplasticizer	1.5 % from flyash

g. Mix Design For Cement Concrete

According to IS 10262-1985 [6] the mix proportion for M25 grade of concrete was arrived.

Water	Cement	Fine aggregate	Coarse aggregate
191.6 lit	476 kg/m^3	473.11 kg/m^3	1290.74 kg/m^3
0.41	**1**	**1**	**2.70**

TABLE 4: Mix proportion for cc

h. Casting and Curing

Usually cube size of 150 × 150 x 150 mm are used for the casting the specimens. The Moulds are tightened. Then oil is applied on the interior of the Mould. Next step the concrete is filled in three layers in the Mould. Each layer is compacted 25 strokes with the tamping rod. Then the surface is

finished. The Mould is left to dry in air for 24 hours. **For geopolymer concrete,** After 48 hours of drying, the moulds are removed. Then the concrete is placed directly in the sunlight for the required number of days. **For conventional concrete**, After 24 hours of drying, the moulds are removed. Then the concrete is placed in the curing tank for the required number of days.

III. RESULTS AND DISCUSSION

Compressive strength test

The results obtained from compressive strength test illustrate polymeric process in geopolymer concrete with Daylight curing treatment . The specimens of geopolymer was tested in the period of 3,7,14,21,28 days. The normal conventional concrete were casted for the grade M25 and the specimens are immersed in the water for curing, the specimens of conventional concrete also tested in the period of 3,7,14,21,28 days. The specimens were casted and tested as per IS: 516-1959.

TABLE 5: Compressive strength of geopolymer concrete

S.No	*Testing days*	*Compressive strength (N/mm^2)*
1.	3	8.77
2.	7	20.84
3.	14	27.11
4.	21	28.44
5.	28	37.33

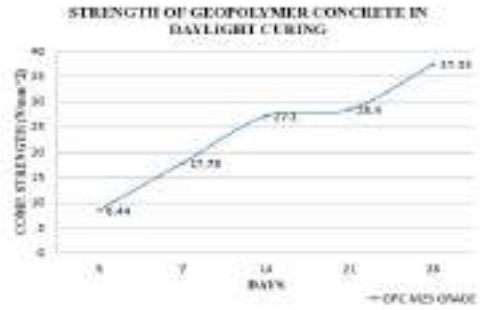

Figure 1: The compressive strength of geopolymer concrete (12m)

TABLE 6: Compressive strength of cement concrete m25 grade

S.No	*Testing days*	*Compressive strength (N/mm^2)*
1.	3	10.66
2.	7	20.88
3.	14	30.66
4.	21	32.89
5.	28	38.22

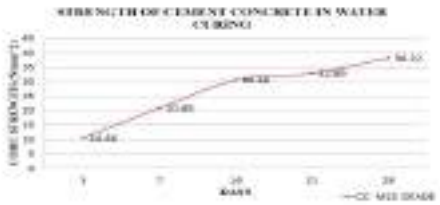

FIGURE 2: The compressive strength of cement concrete with m25 grade

COMPARISION OF GPC vs. CC

FIGURE 3: Strength comparison of geopolymer concrete with cement concrete

The results obtained from compressive strength illustrate polymeric process in geoplymer with daylight curing and cement concrete with water curing treatments. The geopolymer concrete specimens are cured under daylight temperature. Figure 3.10 & 3.11 shows the temperature status of the month February for the region around sivakasi. The maximum average temperature was 33ºC and the minimum average temperature is 20ºC Table 4.1 & figure 4.1 shows compressive strength of the geopolymer concrete specimens were tested in different days.(3,7,14,21,28).Table 4.2 & figure 4.2 shows compressive strength of the cement concrete with M25 grade specimens were tested in different days (3,7,14,21,28).Figure 4.3 Shows strength comparision of geopolymer concrete and cement concrete.

IV. CONCLUSION

1. From our test results, we observed that the geopolymer concrete attains the compressive strength without hydro-curing.
2. In practical, oven curing is not suitable during

construction and is uneconomical. To overcome these difficulties, we prefer the daylight curing. While Compared to the hot air oven curing and steam curing, the GPC specimens attains the expected compressive strength under daylight curing and it is more beneficial.

3. The M25 grade geopolymer concrete attains its

target strength within 14 days of daylight curing with full elimination of cement and water curing.

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Tests And Criteria For Concrete Resistant To Chloride Ion Penetration

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ABSTRACT

The target experimentally investigate the effect of chloride resistance concrete with addition of Ground granulated blast furnace blast slag(GGBS) and Sodium Meta Silicate in varying proportions. In this paper examines effect of that material to the concrete on chloride resistance and voids filling as in concrete. The GGBS act as a filler in concrete. The experimental studies had conducted on mechanical properties tests and durability tests. The mechanical properties are compressive strength, split tensile strength and pullout test. The pullout test have been conducted to study the influence of reinforcing bar corrosion and cracking on bond behavior and bond strength of reinforced concrete members. Pullout tests are used to simulate severe local corrosion to simulate relatively uniform corrosion, along the reinforcing bar surface. The durability studies had to conducted on chloride penetration test and Rapid chloride permeability test (RCPT). Measured apparent chloride diffusion coefficients were correlated with results of rapid index test methods that provide an indication of the characteristics of concrete. A set of rapid chloride test methods and specification criteria that can reliably classify mixtures based on their resistance to chloride ion penetration are proposed.

Keywords—GGBS,RCPT,Sodium meta silicate,chloride penetration,Filler

I. INTRODUCTION

Chloride-induced corrosion of reinforcing steel in structures, such as bridges, has been a major concern for many years. Chlorides from deicing salts or seawater can penetrate the concrete and build up over time until the concentration reaches a level sufficient to depassivate the steel. Once this occurs, the steel will begin corroding and eventually the volume of the corrosion products will be sufficient to crack and spall the concrete cover. Corrosion-inhibiting admixtures, both inorganic and organic, have been developed with the goal of delaying the on set of corrosion or slowing the rate of corrosion once the steel has been depassivated. These admixtures work by interfering with the corrosion reaction or by slowing the rate of chloride, oxygen, and moisture penetration by decreasing the permeability of the concrete. Two inorganic corrosion inhibitors were evaluated in this study with the goals of:

1) comparing their performance based on the quantity of chlorides required to initiate corrosion and the rate of corrosion after initiation in cracked as well as uncracked concrete and

2) Examining and explaining the negative impact of the organic inhibitors on compressive strength. Sodium meta silicate and GGBS is an inorganic corrosion inhibitor that helps stabilize the passive layer on the steel surface. In addition to forming a passive layer, sodium meta silicate and GGBS also completes with chloride ions for ferrous ions, preventing the chlorides from initiating corrosion Studies examining the effectiveness of Sodium meta silicate have yielded positive results, with reinforcement in concrete with GGBS exhibiting a longer time to corrosion initiation and correspondingly higher chloride content in uncracked concrete. In addition to serving as a corrosion inhibitor, sodium meta silicate acts as a ponding strength for concrete. To counter act this, ggbs and sodium meta silicate based inhibitors are often combined with a set retarder. No significant reductions in compressive strength have been observed for concrete with sodium meta silicate and GGBS.

II. MATERIALS

A. Cement

The ordinary Portland cement confirming to IS 4031 was used for the preparation of specimens. OPC 53 grade was used.

B. Fine aggregate

Fine aggregate is used in the experimental investigation and confirming to zone-II of IS 383-1970.Sand is used in the work which has the particle was less than 4.75mm.

C. Coarse aggregate

The coarse aggregate particles passing through 20mm and retained on 12.5 mm I.S Sieve used as the natural aggregate which met the grading requirement of IS 383-1970.

D. Water

Water is the most important and least expensive ingredient of concrete. A part of mixing water is utilized in the hydration of cement to form binding matrix in which the inert aggregates are held in suspension until the matrix has harden. The remaining water serves as a lubricant between the fine and coarse aggregate and makes concrete workable.

E. Sodium Meta Silicate

Sodium silicate is the common name for compounds with the formula Na2Sio3. A well known member of this series is sodium metasilicateNa_2O_3si. Its forms known as a water glass or liquid glass these materials are available in aqueous solution and solid form. Its produced by sodium silicate with addition of soda ash and water through the heated in 9000c then taken in thin solid to be make powdered form. Its manufactured by smashed crystal method.

Fig 1- Sodium meta silicate

F. Ground Granulated Blast Slag(GGBS)

Ground granulated blast-furnace slag is the granular material formed when molten iron blast furnace slag is rapidly chilled (quenched) by immersion in water. It is a granular product with very limited crystal formation and is highly cementitious in nature. It is ground to cement fineness and hydrates like Portland cement. After the molten iron is tapped off, the remaining molten slag, which consists of mainly siliceous and aluminous residue is then water-quenched rapidly, resulting in the formation of glassy granulate. This glassy granulate is dried and ground to the required size , which is known as ground granulated blast furnace slag (GGBS).

III. MATERIAL PROPERTIES

A. Cement - Opc 53 grade

- Specific gravity -3.13
- Fineness modulus -3.6%
- Consistency -32%
- Initial setting time-30 mins
- Final setting time -10Hours

B. Fine aggregate

- Specific gravity -2.54
- Fineness modulus -3.33
- Water absorption 0.85%
- Bulk density-1782.46kg/m^3

C. Coarse aggregate

- Specific gravity -2.66
- Fineness modulus -84
- Water absorption 0.56%
- Bulk density-1693.46kg/m^3
- Impact test -15%

D. Sodium Meta Silicate

- Formula : Na_2O_3Si
- IUPAC ID : Sodium metasilicate
- Density : 2.4 g/cm³
- Molar mass : 122.06 g/mol
- Melting point : 1,088 °C
- Soluble in : Water

Conforming to IS:9424-1979 of BIS

TABLE I - Chemical composition of sodium meta silicate

Technical specifications	Nano Hydrate	Penta Hydrate
Total alkalinity by% mass, min	21.00	29.00
Ratio of total alkalinity to total soluble silica	1:1 +0.05	1:1±0.05
Loss on evaporation% by mass, max	59.00	43.50
Matter insoluble in water % by mass, max	0.50	0.50
Free alkalinity %by mass, max	0.80	1.00

E. Ground Granulated Blast Furnace Slag

- Colour Off - white powder
- Bulk density (loose)- 1100 kg /m^3
- Bulk density (vibrated) -1300 kg/m^3
- Relative density -2950 kg/m^3

TABLE II: Chemical composition of GGBS

S.NO	Oxide composition	GGBS
1	Sio_2	37.73%
2	Fe_2O_3	1.11%
3	Al_2O_3	14.42%
4	CaO	37.34%
5	Mgo	8.71%
6	Mno	0.02%
7	Glass	92%
8	Loss of ignition	1.41%
9	Insoluble residue	1.59%

IV. MIX DESIGN

TABLE III: Mix design

Grade of concrete –M30

Water	Cement	Fine Aggregate	Coarse Aggregate
191.58	518	488.64	1142
0.37	1	0.92	2.2

For quantity of materials taken by per meter cube size mix proportions are given below table IV

TABLE IV: Mix Proportions

Mix ID	Cement (kg/m^3)	Fine agg. kg/m^3	Coarse agg. (kg/m^3)	Sodium meta silicate (kg/m^3)	GGBS (kg/m^3)
MC	593	546.3	1306.3	-	-
MGS1	593	518.9	1306.3	27.31	11.68
MGS2	593	505.32	1306.3	40.97	11.68
MGS3	593	491.67	1306.3	54.63	11.68

Mix Proportion ID

a. MC- cement+F.A+C.A

b. MGS1-cement+F.A+C.A+5%sodium metasilicate(replace F.A)+GGBS(20% filler)

c. MGS2-cement+F.A+C.A+7.5%sodium metasilicate(replace F.A)+GGBS(20% filler)

d. MGS3-cement+F.A+C.A+10%sodium metasilicate(replace F.A)+GGBS(20% filler)

V. EXPERIMENTAL WORK

A. Mechanical properties

Compressive strength

Compressive test was conducted in universal compressive testing machine of capacity 200 kN at a loading rate of 2.5 kN/sec. The compressive strength will achieved for thus combination results are below

TABLE V: Compressive strength

Mix Id	7 days (N/mm^2)	28days (N/mm^2)
MC	20	34.5
MGS1	22.6	36.4
MGS2	26.1	37.9
MGS3	24.8	36.2

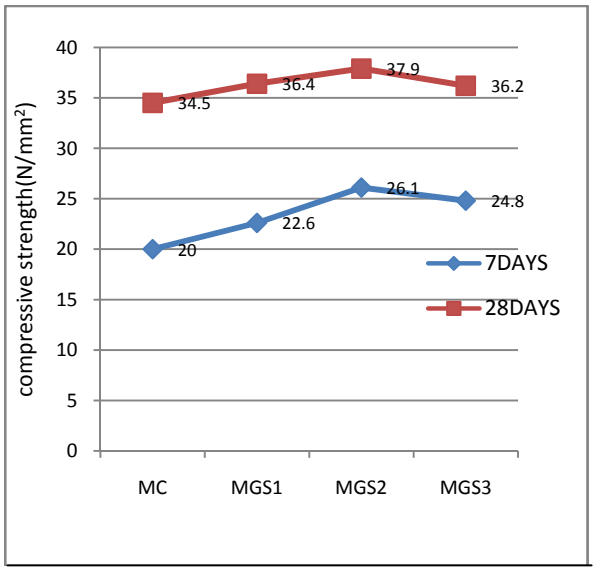

Fig 2 - Compressive strength

Split tensile strength

Split tensile strength test was conducted in universal compressive testing machine of capacity 200 kN at a loading rate of 2.5 kN/sec.

TABLE VI : Split tensile strength

Mix Id	7 days (N/mm^2)	28days (N/mm^2)
MC	1.73	2.758
MGS1	1.7	2.85
MGS2	1.65	2.9
MGS3	1.68	2.98

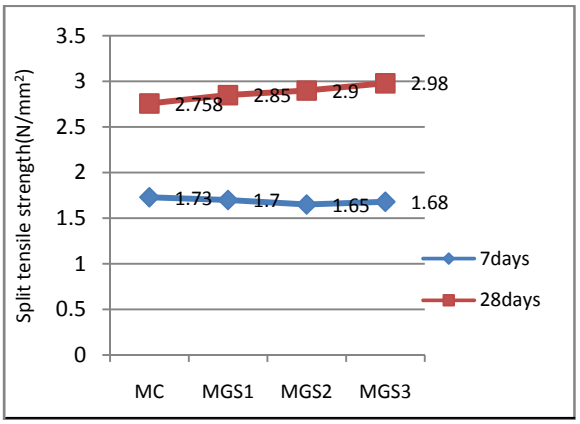

Fig 3 - Split tensile strength

Pull out strength Test

Concrete cylinder of size 150mm diameter and 300mm high were cast with centrally embedded rebar provided up to 16 mm from the face of the cylinder. The rebar extended over the top face of the cylinder. The rebar bonded length in concrete is restricted to 2 to2.4 times of diameter rebar. This test conducted by universal testing machine.

Fig 4- Pullout strength Test

TABLE VII. Pull out strength

Mix Id	Pullout strength (N/mm^2)
MC	43.28
MGS1	36.84
MGS2	34.99
MGS3	34.07

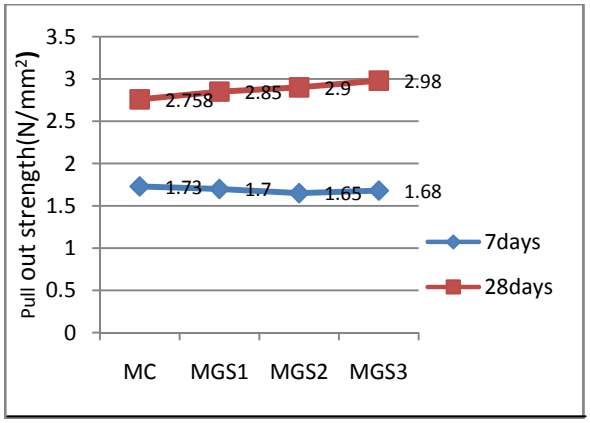

Fig 5 - Pull out strength

A. Durability test

Rapid chloride permeability test (ASTM-C1202)

The Rapid Chloride Penetration Test (RCPT) is used to determine the electrical conductance of concrete to provide a rapid indication of its resistance to the penetration of chloride ions. The RCPT is performed by monitoring the amount of electrical current that passes through concrete discs of 50mm thickness and 100mm diameter for a period of six hours. A voltage of 60 V DC is maintained across the ends of the specimen throughout the test. One lead is immersed in a sodium chloride (NaCl) solution (0.5N) and the other in a sodium hydroxide (NaOH) solution (0.3N). The total charge passed through the cell in coulomb has been found in order to determine the resistance of the specimen to chloride ion penetration.

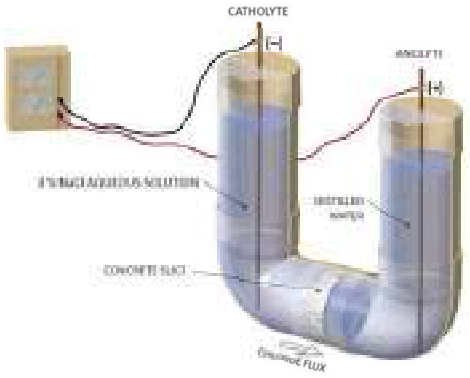

Fig 6 - Model set up for RCPT

$$Q = 900(I_0+2I_{30}+2I_{60}+2I_{90}+2I_{120}+\ldots+2I_{300}+2I_{330}+I_{360})$$

Where,

Q = current flowing through one cell (coulombs)

I_0 = Current reading in amperes immediately after voltage is applied, and

I_t = Current reading in amperes at t minutes after voltage is applied

The table VIII shows the rating of chloride permeability according to ASTM C 1202-97.

TABLE VIII : Rating of Chloride Permeability

Chloride Penetration	Rapid Chloride Permeability Charge Passed (Coulombs)
High	>4,000
Moderate	2,000 to 4,000
Low	1,000 to 2,000
Very Low	100 to 1,000
Negligible	<100

Fig 7 - Rapid chloride permeability Test

TABLE IX. Rapid chloride permeability Test

Mix Id	Charges passed(coulombs)	Chloride penetration
MC	8811	High
MGS1	7784	High
MGS2	6457	High
MGS3	3951	Moderate

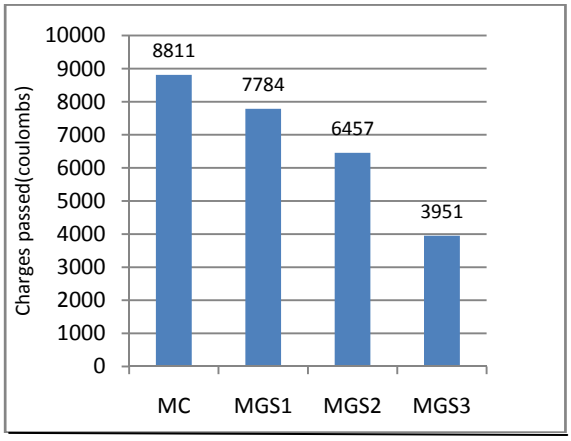

Fig 8 –Rapid Chloride Penetration Test Result

Chloride ion Penetration Test

This study was carried out to find out the influence of Sodium meta silicate and GGBS on chloride ion penetration. The concrete cylinders of 150 mm dia and 300 mm height are cast and,one day later, they are put in contact with a 0.3M CaCl2 solution. The specimens are covered with paraffin in their lower portion, while the upper portion was placed in a PVC pipe, tied to the specimens by a metallic clip. For each concrete mixture three specimens are made. Cylinders are broken after 56days, through splitting test. Chloride penetration depth was measured by using silver nitrate solution as a colorimetric indicator.

Fig 9. Chloride Penetration Test

TABLE X. Chloride Penetration Test Result

Mix ID	Chloride penetration depth(mm)	
	28 days	56 days
MC	3.2	6.2
MGS1	1.5	5.7
MGS2	1.2	8.21
MGS3	1.3	7.28

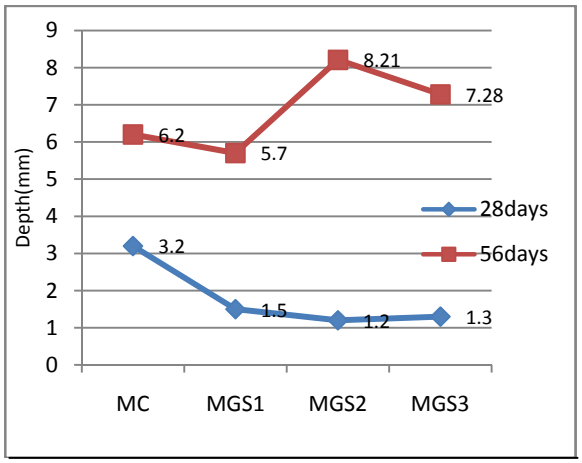

Fig 10- Chloride penetration Test Result

VI. RESULT AND DISCUSSION

Compressive strength

The compressive strength had achieved in MGS2 mix is high. That compressive strength result 26.1N/mm^2 for 7 days and 28 days strength is 36.2 N/mm^2.The low compressive strength is given MGS1 mix proportions.

Split tensile strength

The split tensile strength had achieved in MG2 mix is high. That Split tensile strength maximumresult 2.98N/mm^2 for 7 days and 28 days strength is 3 N/mm^{2}respectively.The low split tensile strength is given control mix proportions.

Pullout strength

The bonding strength had achieved in control mix is high. That bond strength result 43.28N/mm^2 for 7 days and 28 days strength is 36.2 N/mm^2.The low compressive strength is given MGS1 mix proportions.

Rapid chloride permeability Test

The RCPT result is MGS3 mix low level chloride diffusion rate. That to be given 3951coulombs which is moderate level chloride ion penetration. The comparison of conventional mix to their to reduce chloride penetration to increase quantity of sodium meta silicate mix proportion level.

Chloride penetration Test

The test results are conventional concrete and varies mixes to given that varies depth of chloride penetration. Its to be high penetration depth is 8.21mm for MGS2 mix in 56days and 3.2 mm in 28 days for conventional mix concrete compare that other mixes.

VII. CONCLUSION

All three inhibitors tested in this study were effective in increasing the time to corrosion initiation and reducing the chloride diffusion rate of reinforcing steel in uncracked concrete. The inhibitors, however, were significantly less effective in cracked concrete where the reinforcement in concrete containing or showed only slight reductions in corrosion rate compared to the bars in conventional concrete. In this studies sodium meta silicate and GGBS will react as the corrosion resistance material. That means it also as chloride diffusion rate will be controlled.

Its significantly that corrosion initation time controlled to their filler of GGBS used in this concrete as well as increase density of concrete. so its to be given good strength,and corrosion protection is given as the good ponding strength. It concluded in this studies to 7.5% of sodium silicate replace in fine aggregate have a good results compare to the control mix.

Acknowledgment

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I also wish to express my sincere thanks to ***Mr.S.Sivakumar M.E.,*** helpful for further test had to be conducted and supporting staff for their selfless support and cooperation.

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Study on strength of geopolymer mortar by varying the molarity of alkaline solution

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Abstract— *This paper represents the effect on the strength of Class F fly ash based geopolymer mortar. Geopolymer mortar was produced by using unprocessed fly ash, activated with sodium silicate and sodium hydroxide solution. Test was carried out on 70.6mm × 70.6mm × 70.6 mm cube geopolymer mortar specimens. Alkaline Solution to fly ash ratio was 0.35, 0.4, 0.45 & 0.5 and molarity of 10 and 12 were used. The specimens were cured at temperature 80°C for 24 hours. In this research, the influences of parameter on the strength fly ash-based geopolymer mortar were studied. The ultimate compressive strength was obtained for various alkaline solutions to fly ash ratio of mortar specimens.*

Keywords— Class F fly ash; geopolymer mortar; alkaline Solution; molarity; heat curing

I. Introduction

Davidovits (1988; 1994) proposed that an alkaline liquid could be used to react with the silicon (Si) and the aluminum (Al) in a source material of geological origin or in by-product materials such as fly ash and rice husk ash to produce binders. Because the chemical reaction that takes place in this case is a polymerization process, he coined the term 'Geopolymer' to represent these binders. Geopolymer are members of the family of inorganic polymers. The chemical composition of the geopolymer material is similar to natural zeolitic materials, but the microstructure is amorphous. The polymerization process involves a substantially fast chemical reaction under alkaline condition on Si-Al minerals that result in a three-dimensional polymeric chain and ring structure consisting of Si-O-Al-O bonds (Davidovits, 1994). There are two main constituents of geopolymer, namely the source materials and the alkaline liquids. The source materials for geopolymer based on alumina-silicate should be rich in silicon (Si) and aluminum (Al). These could be natural minerals such as kaolinite, clays, etc. Alternatively, by-product materials such as fly ash, silica fume, slag, rice-husk ash, red mud, etc could be used as source materials. The choice of the source materials for making geopolymer depends on factors such as availability, cost, type of application, and specific demand of the end users. The alkaline liquids are from soluble alkali metals that are usually Sodium or Potassium based. The most common alkaline liquid used in geopolymerisation is a combination of sodium hydroxide (NaOH) or potassium hydroxide (KOH) and sodium silicate or potassium silicate.

II. Material use

A. Fly ash

Fly ash consists of finely divided ashes produced by pulverized coal in power stations. During the hydration process, fly ash chemically reacts with the calcium hydroxide forming calcium silicate hydroxide and calcium aluminates, reduces the risk of leaching calcium hydroxide and concrete's permeability. Fly ash also improves the permeability of concrete by lowering the water-to-cement ratio, which reduces the volume of capillary pores remaining in the mass. The fly ash was obtained from Thermal Power Station, Tamilnadu, India. The reaction of fly ash with an aqueous solution containing sodium Hydroxide and Sodium Silicate in their mass ratio, result in a material with three dimensional polymeric chain and ring structure consisting of Si-O-Al-O bonds. The specific gravity, fineness modulus, specific surface area and density of fly ash are 2.82, 1.375, 310 m^2/kg and 1.4 kg/m^3 respectively.

A. *Fine aggregate*

Fine Aggregate (sand) used is clean dry river sand. Zone 2 sand is used in this experiment. Particles passing through 1.18mm sieve were used as fine aggregate.

B. *Alkaline Solution*

Generally the sodium hydroxides are available in solid State in the form of pellets and flakes (NaOH With 98% purity).Sodium Silicate, usually known as “water glass" or “liquid glass”, is well-known due to wide commercial and industrial applications. In order to avoid the effect of unknown contaminants in the mixing water sodium hydroxide pellets were dissolved in distilled water. The activator solution was prepared at least one day prior to its use.

D. Super plasticizer

As a super plasticizer it substantially improved the workability without increasing the amount of water and hence reducing the risk of segregation. Conplast SP430 has been used where a high degree of workability and its retention are likely or when high ambient temperatures cause rapid slump loss. It facilitates production of high quality concrete. The conplast SP430 which was readily available super plasticizer.

III. Preliminary Test on Materials

A. Testing of Fly ash

1. *Fineness Test of Fly ash*

Correctly 100grms of cement was weighed and taken in a standard IS sieve (325 microns).The lumps were broken down and the material was sieved continuously for 15 minutes using sieve shaker. The residue left on the sieve was weighed. Percentage of residue left on sieve = (weight retained/weight taken) x 100

Result: Percentage of residue left on sieve = 0.29%

2. *Specific Gravity Test of Fly ash*

The equipment was dried thoroughly and weighed as W_1 g. The 50 gm of the fly ash was taken and weighed W_2 g. 50gm of the fly ash and Oil is filled in the mark and weighed W_3 g. The instrument was completely filled with a clean cloth . Then the equipment was completely filled with Oil and it was weighed as W_4 g.

Result: Specific Gravity of Fly Ash (G) = 2.02

B. Testing of Fine Aggregate

1. Sieve analysis of fine aggregate

The sample was brought to air – dried condition before weighing and sieving was achieved after drying at room temperature. The air – dry sample was weighed

Fineness modulus =2.8

Zone conformation = Zone-II

2. Specific Gravity Test of Fine Aggregate

The pycnometer was dried thoroughly and weighed as W_1 gram. 200 gram of fine aggregate was taken in the pycnometer and weighed as W_2 gram. The pycnometer was filled with water up to the top. Then it was shacked well and stirred thoroughly with the glass rod to remove the entrapped air. After the air has been removed the pycnometer was completely filled with water up to the mark. The outside of pycnometer was dried with a clean cloth and it was weighed as W_3 grams. The pycnometer was cleaned thoroughly. The pycnometer was completely filled with water up to the top. Then outside of the pycnometer was dried with a clean cloth and it was weighed as W_4 grams.

Result: Specific Gravity of Fine Aggregate (G) = 2.62

IV. Mix Design

This experimental study on strength of geopolymer mortar by varying molarity and alkaline solution to fly ash ratio by trial and error method.

Proportion for mix:

- Sodium Hydroxide Concentration = 10M & 12M
- Sodium Hydroxide to Sodium Silicate Ratio = 1:1
- Alkaline Activator to Fly ash Ratio = 0.35, 0.4, 0.45 & 0.5
- Superplasticizer = 1% weight of fly ash
- Curing Type = Oven Curing
- Curing Period = 24 hours @ 80°C

Sodium hydroxide solution prepared by,

Reference from **“Perry’s handbook for Chemical engineers”**

The geopolymer mortar used in this study is composed of low calcium fly ash and alkaline solution composed NaOH and sodium silicate combination. NaOH is mixed with soluble in water at a concentration of 10M & 12M and in the ratio of Alkaline Activator and Fly ash is 0.35, 0.4, 0.45 and 0.5. It kept for at least 24 hours prior to casting. All the geopolymer mortar was made with sand -to- fly ash ratio by equal proportion. The hydroxide to silicate ratio is kept constant as 1:1. The fly ash and fine aggregates were dry mixed together in mixer machine for 5 min, followed by the addition of activator solution containing hydroxide and silicate to the mixture, and mixed for another 10 min. The mixing was carried out in a room temperature of approximately 25-30°c.

Then Geopolymer mortar is poured into the mould. For each specimen mortar cubes of size 70.7 mm × 70.7 mm × 70.7 mm cast to test the characteristic strength of the mortar mix. The mould could be easily separated from cast elements after its initial setting .The contact surface of the mould to the mortar were greased before casting the specimens to ease the demoulding process. The geopolymer mortar was cured above heated 80°C for 24 hours, used in heat chamber.

IV. Compressive strength of Geopolymer mortar

Compressive strength is an essential property for all where it also depends on curing time and curing temperature. When the curing time and temperature increase, the compressive strength also increases. With curing temperature in range of 60ºC to 90ºC, within time in 24 to 72 h, the compressive strength of concrete can be obtained about 400 to 500 kg/cm^2. In addition, the compressive strength of geopolymer also mainly depended on the content of fly ash fine particles (smaller than 43 μm).The compressive strength was increase when the finest of fly ash increase. Hence the nature and the concentration of the activators were dominant factors in the reaction of alkali activation. The highest compressive strength was obtained using a solution of sodium silicate as an activator (n = 1.5; 10% Na2O). Sodium silicate is the most suitable as alkaline activator because it contains dissolved and partially polymerized silicon which reacts easily, incorporates into the reaction products and significantly contributes to improving the mortar characteristics,

$F_c=p/A$ N/mm^2 (or) MPa

Where, Fc=compressive strength

P=maximum load taken by the specimen,

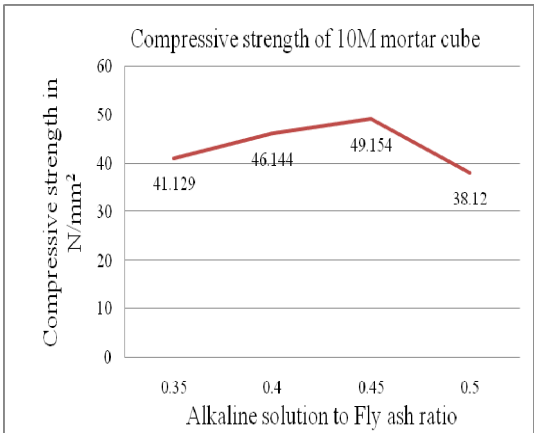
A=surface area of specimen

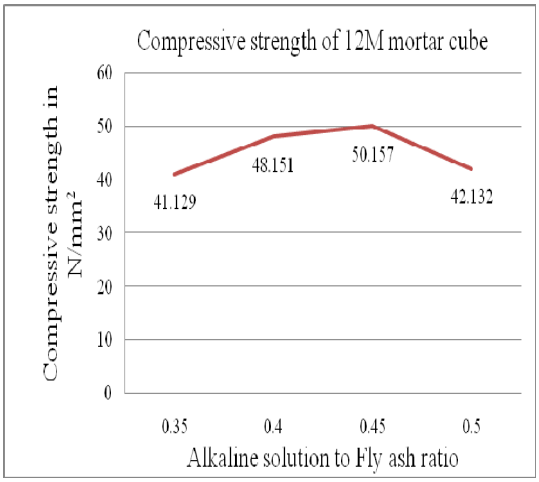
The compression test is conducted on three specimens and average compressive strength is calculated for each mix.

C. Result and discussion

The geopolymer mortar is environment friendly, since the usage of fly ash which is the waste material and reduction in the greenhouse gases due to the complete cement replacement. The strength of the geopolymer specimen was increased by varying molarity. The results are tabulated below.

MOLARITY	ALKALINE ACTIVATOR/ FLY ASH RATIO	DENSITY Kg/m^3	LOAD KN	COMPRESSIVE STRENGTH N/mm^2
10	0.35	2074.5	205	**41.129**
	0.4	2034.7	230	**46.144**
	0.45	2017.6	245	**49.154**
	0.5	1975.0	190	**38.120**
12	0.35	2077.3	205	**41.129**
	0.4	2040.4	240	**48.151**
	0.45	2017.6	250	**50.157**
	0.5	1977.9	210	**42.132**





D. Conclusion

From the experimental results reported in this paper, the following conclusions are drawn;

a) The mortar produces ultimate compressive strength of heat curing in 24 hrs.
b) The activated alkali solution to fly ash ratio 0.45 gives a gradual compressive strength on different molarity.
c) Higher concentration of activated alkali solution results in achieving the optimum compressive strength.
d) Heat curing plays a vital role to reduce the time and increase the strength.
e) The percentage increase in compressive strength of the specimen with increase in molarity decreases.

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Mechanical Properties of High Performance Concrete using Steatite powder

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Abstract*—Concrete is probably the most extensively used construction material in the world. The addition of mineral admixture in cement has dramatically increased along with the development of concrete industry, due to the consideration of cost saving, energy saving, environmental protection and conservation of resources. However, environmental concerns both in terms of damage caused by the extraction of raw material and carbon dioxide emission during cement manufacture have brought pressures to reduce cement consumption by the use of supplementary materials. Mineral admixtures such as fly ash, rice husk ash, silica fume etc are more commonly used in the development of HPC mixes. Addition of such materials has indicated the improvements in the strength and durability properties of concrete. In the present investigation, a feasibility study is made to utilize the Steatite powder and Metakaolin as an mineral admixtures in HPC and to investigate the mechanical and durability properties of concrete. The properties of cement, fine aggregate, coarse aggregate and water for M60 grade concrete is arrived. HPC mixes incorporating different percentages of Steatite powder by weight of cement along with 10% of Metakaolin. HPC with mineral admixture of Steatite powder at the replacement levels of 0%, 5%, 10%, 15% & 20% along with industrial by-products of Metakaolin at the replacement level of 10% were studied. The strength characteristics such as compressive strength, tensile strength and flexural strength were investigated to find the optimum replacement of mineral admixture and by-product admixture.*

****CRITICAL: Do Not Use Symbols, Special Characters, or Math in Paper Title or Abstract.*** **(***Abstract***)**

Keywords—component; formatting; style; styling; insert (key words)

I. INTRODUCTION (*HEADING 1*)

Conventional concrete in India is often produced with four components namely, a) cement and b) Water, together they act as binder. c) The crushed or uncrushed stone and d) natural sand or stone dust. In addition to the above ingredients one or two additional chemicals are also added to the recipe of concrete in order to enhance some properties. Certain materials of mineral origin are also added to concrete to enhance their strength and durability properties of concrete materials such as flyash, silicafume, metakalion which are generally very fine, may be finer than cement, when added to concrete in right proportion can improve the strength and durability of concrete drastically and high strength and high performance concrete is obtained in this manner.

High Performance concrete means concrete which meets special combination of performance and uniformity requirements that cannot be achieved through normal mixing, placing and curing techniques.

HPC is a concrete that has been designed to be more durable and if necessary, stronger than conventional concrete. HPC mixtures are essentially composed of the same materials as conventional concrete mixtures. But the proportions are designed or engineered to provide the strength and durability needed for the structural and environmental requirements of the project.

The demand for Portland cement is increasing significantly in developing countries. Portland cement manufacture is one of the major reasons for CO_2 emissions into atmosphere. It is due to the use of fossil fuels, essential to generate electricity during cement manufacturing process.

The cement industry is one of the two primary product producers of carbon-di-oxide(CO_2), create up to 5% of worldwide man –made emissions of this gas, of which 50% is from the chemical process and 40% from burning fuel. The CO_2 emission from the concrete is directly proportional to the cement content used in the concrete; 900 kg of CO_2 are emitted for the manufacture of every ton of cement. However, environmental concerns concerning rapid utilization of natural resources and CO_2 emission during cement manufacturing process have brought pressure to reduce cement consumption by the use of cement replacement materials (CRMs).

Pozzolanic additives are the materials or admixtures that can improve concrete properties such as concrete strength, durability and impermeability. Pozzolanic additives are used either as partial substitutes of Portland cement or as an addition. The use of pozzolanas for making concrete is considered efficient, as it allows the reduction of the cement utilization while improving the strength and durability properties of the concrete.

The use of supplementary cementitous materials (SCMs) is essential in developing low cost

construction materials for use in developing countries.

Metakaolin differs from other supplementary cementitious materials (SCMs), like fly ash, silica fume in that it is not a by-product of an industrial process; it is manufactured for a specific purpose under carefully controlled conditions. Metakaolin when used as a partial substitute substance for cement, it reacts with $Ca(OH)_2$ one of the by-products of hydration reaction of cement and results in additional C-S-H gel which results in increased strength. Metakaolin is obtained by thermal creation of kaolin clay. This activation will cause a considerable loss of water in its constitution causing a rearrangement of its structure. To find an adequate thermal activation, the temperature range should be established between 650 to 750ºC. Metakaolin is used in oil well cementing to advance the compressive and flexural strength of the hardened cement. Metakaolin also reduces the hardened cement impermeability to liquids and gases. Hence by partially replacing Portland cement with Metakaolin not only reduces CO_2 emissions but also increases the repair life of buildings.

Chemical formula of Metakaolin is $Al_2O_3 \cdot 2SiO_2 \cdot 2H_2O$.

II. Material Details

A. Cement

The most important feature in concrete is Cement. The important criteria for the selection of cement are binding property and it produces microstructure in concrete. OPC of 53 Grade locally available is used in this investigation. The Cement is tested for different properties as per the IS: 4031–1988 and found to be confirming to various specifications of IS: 12269–1987.

Standard Consistency	Specific gravity	Initial setting time in min	Final setting time in min
32.5%	3.13	34	554

TABLE I. PHYSICAL PROPERTIES OF CEMENT

B. Coarse aggregates

The crushed aggregate were collected from the local quarry. The aggregates are locally available. The fractions from 20 mm to 4.75 mm are used as coarse aggregate. Specific gravity of aggregate is 2.75 and Fineness modulus of 6.73. Aggregates are the most mined material in the world.The coarse aggregate used in this experimentation were of 20mm and down size aggregate and tested as per IS: 2386-1963 (I, II and III) specifications. Physical and mechanical properties of coarse aggregates are given in Table II.

Properties	Results	Permissible limit as per IS: 2386-1963
Specific gravity	2.75	In between range 2.6-2.8
Moisture content	0.7%	-
Fineness modulus	6.73	-

TABLE II.PHYSICAL AND MECHANICAL PROPERTIES OF COARSE AGGREGATE

C. fine aggregates

Locally available river sand was used as fine aggregate. The sand used having fineness modulus 3.76 and confirmed to grading zone-II as per IS: 383-1970 specification. Physical properties of fine aggregate are given in Table III.

TABLE III.PHYSICAL PROPERTIES OF FINE AGGREGATE

Property	Results	Permissible limit as per IS: 383-1970
Specific gravity	2.68	Should be between the limit 2.6-2.7
Moisture Content	0.65%	-
Fineness modulus	3.76	-
Grading	Zone-II	-
Bulk density a. Loose b.Compacted	14.67kN/m^3 16.04 kN/m^3	-

D. Water

As per IS: 456-200 Portable water was used for concreting .Water to be used for mixing and curing should be free from harmful materials. In this study, tap water was used for both mixing and curing purposes.

E. Natural Steatite

Natural steatite is also called soapstone or soaprock. It is a talc-schist ($Mg_3Si_4O_{10}(OH)_2$) which is a type of metamorphic rock. It is chiefly composed of the mineral talc and is thus rich in magnesium. Soapstone is moderately soft because of its high talc content, talc having a definitional value of 1 on the Mohs hardness scale. Softer grades may experience soapy when touched. There is no permanent hardness for soapstone because the amount of talc it contains varies broadly.

F. Metakaolin

Metakaolin is a chemical segment that forms upon thermal treatment of kaolinite. Kaolinite's chemical composition is $Al_2O_3{:}2SiO_2$. $2H_2O$ and as a result of thermal treatment in the range of 400-500°C, the water is driven away to form an amorphous aluminosilicate called metakaolin. Metakaolin is white in colour and acts as a pozzolanic material. The reactivity of the metakaolin may also be affected by grinding to a finer particle size. Metakaolin when used as a partial replacement substance for cement in concrete, it reacts with Ca(OH)2 one of the by-products of hydration reaction of cement and results in additional C-S-H gel which results in increased strength.

III. MIX DESIGN

A. Mix Proportion

The aim of mix proportioning is to attain required strength at optimum cost and to enhance the critical, noncritical properties. Mix proportion selection is often best handled by using ACI method combined with EFNARC Guide lines.Mix design is done as per ACI method for M60grade concrete of code ACI 211.4R-93.

Mix	Cement kg/m³	F.A kg/m³	C.A kg/m³	Water litre/ m³
1:1.2:2.62	496.640	606.85	1302.34	151. 475

TABLE V. MIX PROPORTIONS

B. Combinations of Mixes

Mix designation	Mix combinations
CC	C+S+CA
HPC-SM1	C+5%SP+10%MK
HPC-SM2	C+10%SP+10%MK
HPC-SM3	C+15%SP+10%MK
HPC-SM4	C+20%SP+10%MK

TABLE VI. MIX COMBINATIONS

IV. CASTING AND CURING OF SPECIMENS

Concrete testing specimens of required number were casted and cured for 28days, which is correspond to M60 grade of concrete with water binder ratios 0.32 and replacement of cement by Steatite powder for various percentages viz 5,10,15 and 20 along with 10% of Metakaolin. Concrete specimens of size 150 x 150 x 150 mm were casted to find residual compressive strength and size of 100m x 100mm x 100mm were casted to find percentage weight loss after 28 and 56 days of hydrochloric acid immersion.

The specimens were cast in well lubricated moulds. Concrete were placed on the mould and compacted thereafter and left at room temperature for 24hrs before being transferred into the curing tank. After 24 hours, they wereimmersed in water curing tanks until their testing ages.

V. EXPERIMENTAL PROCEDURE

A. *Compressive Strength Test:*

The cube compressive strength results at the 28 days for different replacement levels of Steatite powder along with 10%
Metakaolin of cement. Three specimens were casted for each mix and average value was taken. Specimens were tested on compressive testing machine as per IS 516:1959.

Compressive strength = P/A

Where,

P = Maximum load in N applied to the sample

A = Cross sectional area of the specimen in mm^2

B. *Split Tensile Strength:*

It is an indirect experiment to determine the tensile strength of cylindrical specimens. It was carried out in compression testing machine as per IS 5816:1999.Three specimens were casted for each mix designation and average value was taken.
Split tensile strength test for all mix variations were done for 7 & 28 days and test results obtained are tabulated in Table VIII.

F = 2P/LD

Where, P = Load in N
L = Length of the specimen in mm
D = diameter in mm

C. *Flexural strength:*

It is used to determine of modulus of rupture an unreinforced concrete beam to resist the failure. Flexural strength is depends on the type, size and volume of coarse aggregate used. Three specimens were casted for each mix and average value was taken. Split tensile test was carried out in compression testing machine as per IS 5816:1999.

Flexural strength $F = PL/BD^2$ in N/mm^2

Where,
P = Ultimate load applied to the specimen in N
L = Length of specimen between supports in mm
B = Breadth of the specimen in mm
D = Depth of the specimen in mm

D *Acid Attack:*

The concrete cube specimens of different concrete mixtures of size 100 mm were cast, and after 28 days of water curing, the specimens were removed from the curing tank and allowed to dry for one day. The weights of concrete cube sample were taken. The acid attack test on concrete cube was conducted by immersing the cubes in the acid water for 90 days after 28 days of curing. Hydrochloric acid with pH of about 2 at 5% weight of water was added to water, in which the concrete cubes were stored. The pH was maintained throughout the period of 90 days. After 90 days of immersion, the concrete cubes were taken out of acid water. Then, the specimens were tested for compressive strength. The resistance of concrete to acid attack was found by the Percentage loss of weight of specimen and the Percentage loss of compressive strength on immersing concrete cubes in acid water.

E. ***Sulfate Attack Test:***

The resistance of concrete to sulfate attack was studied by determining the loss of compressive strength or variation in compressive strength of concrete cubes immersed in sulfate water having 5% of magnesium sulfate ($MgSO_4$) by weight of water and those which are not immersed in sulfate water.

Sulphate attack test was carried out by using the concrete cubes of size 150mmX150mmX150mm. The concrete cubes of 150 mm size after 28 days of water curing and dried for 1 day were immersed in 5% MgSO4 and 5% MgSO4 added water for 90 days. The concentration of sulfate water was maintained throughout the period. After 90 days immersion period, the concrete cubes were removed from the sulfate waters and after wiping out the water from the surface of cubes tested for compressive strength following the procedure prescribed in IS: 516-1959. The sulphate attack is obtained from parameters such as loss in mass and loss in strength. This type of accelerated test of finding out the loss of compressive strength is used for determining for assessing sulfate resistance of concrete.

Weight loss (%) = ((W1 - W2)/W1) x 100

V. EXPERIMENTAL RESULTS

TABLE VII. Compressive Strength Test Results

Mix Designation	Compressive Strength in N/mm2	
	7 days	28 days
CC	40.29	61.62
HPC-SM1	42.95	65.03
HPC-SM2	43.55	68.43
HPC-SM3	**46.21**	**72.29**
HPC-SM4	44.22	69.48

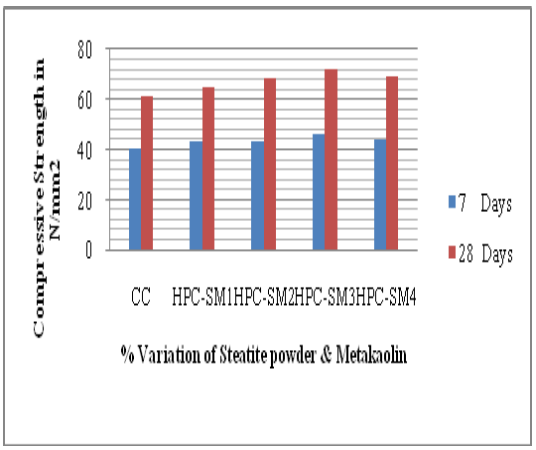

Fig. 1 Comparison of 7, 28 days compressive strength of conventional concrete and Steatite powder admixed concrete

TABLE VIII. Split Tensile Strength Test Results

Mix Designation	Split Tensile Strength in N/mm2	
	7 days	28 days
CC	4.16	5.72
HPC-SM1	4.68	6.43
HPC-SM2	4.90	7.32
HPC-SM3	**5.11**	**7.87**
HPC-SM4	4.73	7.23

Fig. 2 Comparison of 7, 28 days split tensile strength of conventional concrete and Steatite powder admixed concrete

TABLE IX. Flexural Strength Test Results

Mix Designation	Flexural Strength in N/mm2
	28 days
CC	5.32
HPC-SM1	5.58
HPC-SM2	5.75
HPC-SM3	**5.90**
HPC-SM4	5.81

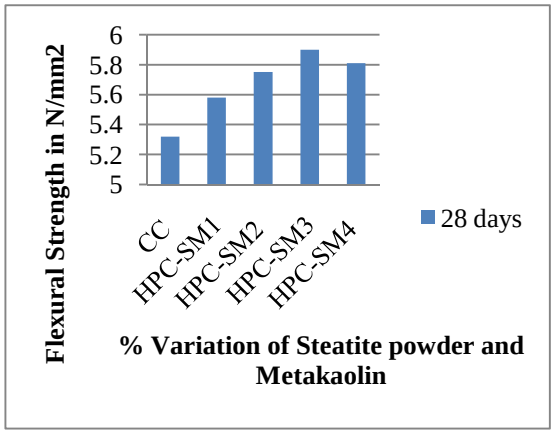

Fig. 3 28 days Flexural strength of conventional concrete and Steatite powder admixed concrete

Mix Designation	Weight before immersion in acid W1 (kg)	Weight after immersion in acid (kg) For 28 days	%loss in Mass for 28 days	%loss in Mass for 56 days
CC	8.416	8.315	1.200	1.307
HPC-SM1	8.652	8.589	0.728	0.797
HPC-SM2	8.407	8.352	0.654	0.713
HPC-SM3	**8.722**	**8.673**	**0.562**	**0.676**
HPC-SM4	8.561	8.486	0.876	0.934

Mix Designation	Weight before immersion in acid (kg)	Weight after immersion in acid (kg) For 28 days	%loss in Mass for 28 days	%loss in Mass for 56 days
CC	8.56	8.45	1.29	1.40
HPC-SM1	8.57	8.51	0.70	0.93
HPC-SM2	8.26	8.2	0.73	0.85
HPC-SM3	**8.48**	**8.44**	**0.47**	**0.71**
HPC-SM4	8.42	8.35	0.83	0.95

TABLE X. Results of acid resistance test

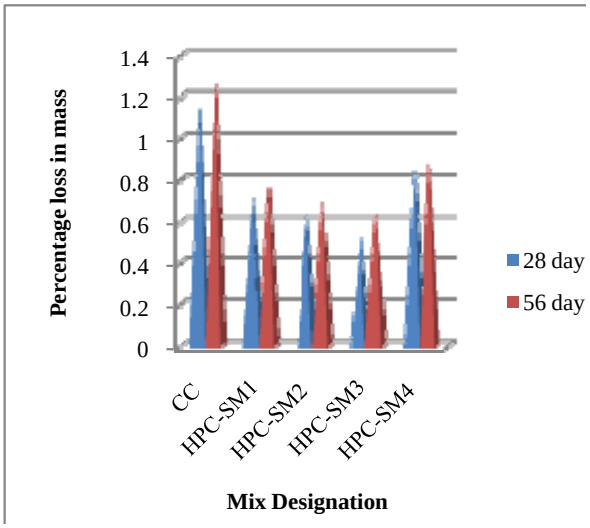

Fig. 4 Weight Loss Due To Sulphate Attack

VI. CONCLUSIONS

1. The compressive strength of concrete for 7&28 days of curing with varying % replacement of Steatite powder and Metakaolin has been increased and have achieved target strength.
2. The split tensile strength of concrete for 7&28 days of curing with varying % replacement of Steatite powder and Metakaolin has been increased and have achieved target strength.
3. The flexural strength of Metakaolin based concrete maintained good result.
4. Concrete mix variations with % replacement of Steatite powder and Metakaolin have showed lower values in case of acid resistance and density of concrete is increased as % replacement of Steatite powder and Metakaolin as increased.

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Health Risk Assessmet Of Alternanthra Sessilis Irrigated In Wastewater

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Abstract—
The present study assesses the health risk caused by heavy metals through the intake of alternanthera sessilis from waste water irrigated area. Heavy metals accumulation in soil and crops is of increasing concern because of the potential human health risks. The present study is aimed to compare and analyze the heavy metal concentration between soils and plants (Alternanthera Sessilis) from land irrigated with freshwater, waste-water, and treated water. Thus the result reveals that Pb, Cd, and Fe in waste water cultivated crops exceeded the permissible limits and the HRI was found out to be maximum. The crops cultivated out of treated water were out of risk. Thus the study reveals that the heavy metal accumulation in vegetables/crops irrigated with waste water will cause health effects to inhabitants.

Keywords— Alternanthera sessilis; *Daily intake; Health risk assessment; Heavy metalts.*

I. INTRODUCTION

The used water (waste water) for irrigation is increasingly being considered as a technical solution to reduce the water scarcity. Waste water contains substantial amounts of beneficial nutrients and toxic heavy metals, which are creating problems for crop production.

Wastewater may contain various heavy metals including Zn, Cu, Pb, Mn, Ni, Cr, Cd, depending upon the type of activities it is associated with. Continuous irrigation of agricultural land with sewage and industrial wastewater may cause heavy metal accumulation in the soil and vegetables.

Heavy metals are generally not removed even after the treatment of wastewater at sewage treatment plants, and thus cause risk of heavy metal contamination of the soil and subsequently to the food chain. Intake of heavy metals through the food chain by human populations has been widely reported throughout the world. Due to the non-biodegradable and persistent nature, heavy metals are accumulated in vital organs in the human body such as the kidneys, bones and liver and are associated with numerous serious health disorders. Individual metals exhibit specific signs of their toxicity. Lead, As, Hg, Zn, Cu and Al poisoning have been implicated with gastrointestinal (GI) disorders, diarrhoea, stomatitis, tremor, hemoglobinuria causing a rust-red colour to stool, ataxia, paralysis, vomiting and convulsion, depression, and pneumonia. The nature of effects can be toxic (acute, chronic or sub-chronic), neurotoxic, carcinogenic, mutagenic or teratogenic.

Some studies have been carried out for several decades to assess the health risk of heavy metals through consuming vegetables from wastewater-irrigated areas (Khan, Sajjad, et al., 2009; Singh, Anita, et al., 2010; Y.Z. Huang., et.al., 2010; Geetanjali Chauhan., 2014; S.M Rajendran., et.al 2014; Muhammad Imran.,et.al 2011).To our knowledge few studies have been carried out that have analyzed heavy metals in agro-products and evaluated potential health risks to inhabitants.

In the present study, the concentrations of heavy metals in locally produced CROP(alternanthera sessilis) were quantified through 6months at a rural area of Virudhunagar district of India, where treated and untreated wastewater has been used as a source of irrigation water. The contamination levels in soil and vegetable/cereal crops were evaluated with

respect to the prescribed safe limits of different heavy metals set under national and international norms. A number of standard measures were used to assess the health risks associated with the measured levels of heavy metal contamination at the study sites.

II. MATEERIALS AND METHODS

A.Study site

Agriculture land at chinnamanur village located in Theni district was selected as the study area. Three main zones were selected on the basis of fresh water, waste water and treated water irrigation. Fresh water site was irrigated using the clean water available in the well at the irrigation land area and waste water taken from municipal sewage. The third zone area is the treated water site where the municipal sewage is get treated and the water is used for irrigation.

B.Sample Collection

Soil & water sampling

Soil and water samples were collected by digging out, from three sites of Clean water, wastewater and treated water irrigated sites. Soil samples were air dried, crushed and stored at ambient temperature before analysis. The clean ,wastewater , and treated water samples (100 ml of each) used for irrigation were collected in bottle and 1 ml of concentrated HNO3 was added in the water sample to avoid the microbial activity.

C.Plant sampling

Alternanthera Sessilis crops were grown in the study area were collected from each site of sampling zone and stored in polythene bags and kept in laboratory. Hence, totally 3 types of samples were collected from each irrigation sites. Leaves of Alternanthera sessilis were then oven dried and ground into powdered form for digestion. 1 g of soil and powdered alternanthera sessilis samples were digested by 15 ml Tri acid mixture i.e. HNO3, H2SO4, HClO4 at 5:2:1 ratio until the transparent solution appeared. The tri acid mixture extraction was used for the heavy metal analysis. The heavy metals accumulated in soil, water and crops were determined by atomic adsorption spectrophotometer.

III. DATA VALIDATION

A.Enrichment factor

The metals from soil get transferred to the crops was determined as Enrichment factor (EF),

$$EF = C_{crops}/C_{soil}$$

Where, C_{crops} = Concentration of heavy metals in crops
C_{soil} = Concentration of heavy metals in soil

B.Human Exposure Assessment

To assess the health risk of heavy metals, it is necessary to calculate the level of human exposure to that metal by tracing the route of exposure of pollutant to human body. There subsist many exposure routes for heavy metals that depend upon a contaminated media of soil and crops on the recipients. In the present study, metal concentrations in the collected crops were used to calculate the hazard index (HI).

$$Dose = C_{metal} \times D_{food\ intake} / B_{avg.\ weight}$$

C_{metal}=concentration of heavy metals in food
$D_{food\ intake}$= Daily food intake
$B_{avg.weight}$= Average body weight
Hazard Index is the ratio of absorbed dose (exposure of heavy metals) to the reference dose (RfD)
HI<1 is an acceptable situation
HI>1 needs the heavy metal concentration to be decreased

HI=Dose/RfD

Rfd value for Zn, Pb, Cr, Cd, Fe, Mn and Cu is 0.2, 0.004, 1.5, 0.001, 0.02, 0.033 and 0.04 (mg/kg bw/day) respectively (US-EPA,2006).

IV. RESULTS & DISCUSSION

A.Physico-Chemical characteristics of samples

The physico–chemical characteristics of the clean water, wastewater and treated water which were used for the cultivation of the crops were analyzed and tabulated as below.

Table.1Characteristics of water

Sample water	Characteristics				
	pH	TS (mg/l)	TDS (mg/l)	TSS (mg/l)	COD (mg/l)
Clean water	8.3	122	122	-	-
Waste water	4.81	435	302	19	125
Treated water	6.8	161	154	14	56

B. Heavy metal concentration in soil and water samples

Heavy metal concentrations were determined by using Atomic Adsorption Spectrophotometer. Extraction made using tri acid mixture was used for the heavy metal analysis. Heavy metal concentration

in irrigated water at clean water zone, wastewater zone and treated water zone was analyzed and results were shown in the table.2.

Table.2Heavy metal concentration in soil and water samples

SAMPLES	Zn	pb	Cr	Cd	Fe
CLEAN WATER	bdl	0.036	bdl	0.0134	0.4
WASTE WATER	bdl	0.320	bdl	0.0143	0.006
TREATED WATER	bdl	0.0130	bdl	0.0100	0.005
CLEAN WATER SOIL	98.3	bdl	bdl	6.3	4600
WASTE WATER SOIL	0.76	155	bdl	14	3828
TREATED WATER SOIL	54.6	10.7	bdl	7.1	2756

The above table revealed that wastewater irrigated soil was enriched in Cd ,Pb and increased Fe values. Table shows the heavy metal concentration incrops

Table3.Heavy metal concentration in crops

SAMPLES	Zn	pb	Cr	Cd	Fe
FRESH WATER (Alternanthera Sessilis)	15.9	154.8	bdl	99.9	179.31
WASTE WATER (Alternanthera Sessilis)	62	234.15	bdl	134.8	543.06
TREATED WATER (Alternanthera Sessilis)	19	188.50	bdl	1.0175	372.26

*bdl – Below detecteable level

Mg and cu where below detectable level in the samples .

The Table.3 shows the concentration of heavy metals in alternanthera sessilis and Table.4 shows the enrichment factor of soil to crop.

The EF values were high in crops for Zn and Cd grown in wastewater zone.

Table.4Heavy Metal enrichment factor in crops

SAMPLES	Zn	Pb	Cr	Cd	Fe
FRESH WATER (alternanthera Sessilis)	0.161	0	Bdl	0	21.3
GREY WATER (alternanthera Sessilis)	81.5	0.99	Bdl	7.1	0.118
TREATED WATER (alternanthera Sessilis)	0.35	17.6	Bdl	0.143	0.135

Daily Intake of metals

DIM calculated for people exposed to the crops were presented in the table. These data revealed that the values of daily intake of metal were high for crops grown at Grey water zone comparing to the crops grown at fresh water zone.

Table 5.Daily Intake Metals

SAMPLES	DIM(mg/day/kg bw)				
	Zn	Pb	Cr	Cd	Fe
FRESH WATER (alternanthera Sessilis)	0.206	2.011	bdl	1.29	2.32
GREY WATER (alternanthera Sessilis)	0.805	3.042	bdl	1.751	7.055
TREATED WATER (alternanthera Sessilis)	0.24	2.44	bdl	0.013	4.836

The results arrived for DIM values it is clear that Chromium and Copper possesses low values and other metals such as Lead, Cadmium and Zinc carries high DIM values and hence their HI index would be increased due to high daily intake of those metals.

Hazard index

The hazard index of heavy metals in the alternanthera sessilis were tabulated in Table.6.In waste water zone the maximum HI were found for Spinach especially for pb and Cd. In fresh water and treated water zone shows high HI values for pb and Cd. Hence it is advised that an attention is required for the implementation of proper means to monitor and regulate the municipal effluents.

Table.6Hazard index of heavy metals

SAMPLES	Zn	Pb	Cr	Cd	Fe
FRESH WATER (alternanthera Sessilis)	0.68	1.087	bdl	5.087	0.345

GREY WATER (alternanthera Sessilis)	2.68	1.23	bdl	2.111	0.654
TREATED WATER (alternanthera Sessilis)	0.8	1.10	bdl	3.456	0.411

V. Conclusion

The alternanthera sessilis cultivated in freshwater, grey water and treated water were collected and analyzed for the heavy metals concentrations. The concentration of Pb and Cd shows major difference in the heavy metal accumulation for the crops cultivated in three different zones.The present study revealed that wastewater irrigated soil was enriched in Cd and Pb. These data revealed that the values of daily intake of metal were high for alternanthera sessilis grown at waste water zone comparing to the vegetables grown at clean water zone and treated water zone. HI of the study suggest that alternanthera sessilis pose severe health risk with regard to the pb and Cd.

Acknowledgment

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EXPERIMENTAL INVESTIGATION ON ARAMID FIBER REINFORCED SELF COMPACTING CONCRETE

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***Abstract*—Self-compacting concrete has an enhanced ability to flow. It is known to result in an increased segregation and bleeding potential. This paper discusses the results of an experimental investigation into the properties of self-compacting concrete mixes having 0.15% of aramid fiber and 1% dosage of high-performance superplasticizer melamine sulfonate and also to increase the tensile strength in concrete by using aramid fiber.The workability was assessed using three tests according to the specification of self compacted concrete (slump flow, L- box differential height and V-funnel tests).**

Keywords— Self compacting concrete, Aramid fiber, Superplasticizer.

I.INTRODUCTION

Self-compacting concrete (SCC) is a flowing concrete mixture that is able to consolidate under its own weight. The highly fluid nature of SCC makes it suitable for placing in difficult conditions and in sections with congested reinforcement. Use of SCC can also help minimize hearing-related damages on the worksite that are induced by vibration of concrete. Another advantage of SCC is that the time required to place large sections is considerably reduced.

When the construction industry in Japan experienced a decline in the availability of skilled labour in the 1980s, a need was felt for a concrete that could overcome the problems of defective workmanship. This led to the development of self-compacting concrete, primarily through the work by Okamura[1]. A committee was formed to study the properties of self-compacting concrete, including a fundamental investigation on workability of concrete, which was carried out by Ozawa etal[2]at the University of Tokyo. The first usable version of self-compacting concrete was completed in 1988 and was named "High Performance Concrete", and later proposed as "Self Compacting High Performance Concrete".

Testing of concrete in its fresh state is a major focus of this study. SCC is defined by its behaviour when it is in the fresh state, and it is determined whether concrete meets certain requirements, while fluid is paramount in qualifying concrete as SCC or not. The slump flow, L-box and V-funnel are all used for all mixes of this study.

As the dosage of super plasticizer increases, the slump flow increases. This is expected because as the super plasticizer dosage increases the fluidity of the concrete also increases.

This type of concrete is ideal to be used in the following applications:

- Drilled Shafts Columns.
- Earth Retaining systems.
- Areas with high concentration of rebar and pipes.
- Improved constructability.
- Labour reduction.
- Bond to reinforcing steel.
- Improved structural Integrity.
- Accelerates project schedules.
- Reduces skilled labour.

1.1 FIBER

Fiber Reinforced Concrete can be defined as a composite material consisting of mixtures of cement, mortar or concrete and discontinuous, discrete, uniformly dispersed suitable fibers. Fiber reinforced concrete is of different types and properties with many advantages. Continuous meshes, woven fabrics and long wires or rods are not considered to be discrete fibers.

Fiber is a small piece of reinforcing material possessing certain characteristics properties. They can be circular or flat. The fiber is often described by a convenient parameter called "aspect ratio". The aspect ratio of the fiber is the ratio of its length to its diameter. Typical aspect ratio ranges from 30 to 150.

The amount of fibres added to a concrete mix is measured as a percentage of the total volume of the composite (concrete and fibres) termed volume fraction typically ranges from 0.1 to 3%. Aspect ratio (L/D) is calculated by dividing fibre length (L) by its diameter (D).

TABLE 1.1 ASPECT RATIO OF THE FIBER

Type of Concrete	Aspect Ratio	Relative Strength	Relative Toughness
Plain concrete	0	1	1
With	25	1.5	2.0
Randomly	50	1.6	8.0
Dispersed Fibers	75	1.7	10.5

1.1.1 ARAMID FIBER

Aramid fiber is a great composite material. It has high tensile strength, higher resistance, less wear tear. It has also two types they are Para aramid and Meta aramid. This fiber is produced by chopping a bundle made of epoxy-impregnated, braided aramid filaments. Its appearance is similar to that of steel fiber but it gives high tensile strength compared to other.

Fig 1.1 Aramid Fiber

Aramid fibers are class of heat-resistant and strong synthetic fiber. They are used in reinforcement composites, aerospace and military applications, for ballistic-rated body aramic fabric and ballistic composites, in bicycle tires, and as an asbestos substitute. The name is a portmanteau of "aromatic polyamide".

II. LITERATURE REVIEW

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III. EXPERIMENTAL MATERIALS AND METHODOLOGY

3.1 METHODOLOGY

1. Collection of materials
2. Finding material properties
3. Casting
4. Curing
5. Compressive and Split tensile strength tests
6. Result and discussion
7. Conclusion.

3.2 MATERIAL USED

3.2.1 CEMENT

Ordinary Portland cement (43 grade) was used for casting all the specimens.

3.2.2 FINE AGGREGATE

Clean and Dry River sand available locally belongs to zone II is used. Sand passing through IS 4.75mm Sieve is used for casting all specimens.

3.2.3 COARSE AGGREGATE

Crushed granite aggregate with specific gravity of 2.64 and passing through 20mm sieve and retained on 10mm is used for casting all specimens.

Several investigations concluded that maximum size of coarse aggregate should be restricted in strength of the composite.

3.2.4 CHEMICAL ADMIXTURE

A vertical slump of 120mm was aimed and it was achieved by adding commercially available super-plasticizer (Melamine Sulfonate) of 0.2% weight of cement to the normal mix.

3.2.5 SPECIMEN

Concrete Cubes having a cross-section of 150x150x150mm and 150mm diameter & 300mm height of Cylinders were used.

3.3 MATERIAL PROPERTIES

TABLE 3.1 MATERIAL PROPERTIES

S.NO	MATERIAL PROPERTIES	OBTAINED VALUE
1.	Fineness modulus of cement	3.8
2.	Fineness modulus of fine aggregate	2.8
3.	Specific gravity of cement	3.15
4.	Specific gravity of fine aggregate	2.6
5.	Specific gravity of coarse aggregate	2.64
6.	Bulk density of coarse aggregate	1641.19 kg/m^3
7.	Bulk density of fine aggregate	1559.68 kg/m^3

3.4 MIX DESIGN

- Using EFNARC method of mix design, the concrete mix was designed for M30.
- The mix proportion is 1:1.74:1.69 with a water cement ratio is 0.42.
- A slump flow of 500mm was aimed and it was achieved by adding super plasticizers of 1% weight of the cement to the normal mix. For M30 grade of concrete.
- The specimens were casted for 150mmx150mmx150mm cube, and 150mm dia & 300mm height cylinder.
- The cubes and cylinders were placed in water for curing about 28 days. The cubes were tested in CTM.

IV. EXPERIMENTAL PROCEDURE

4.1 WORKABILITY PROPERTIES OF CONCRETE

The discussion of the test on fresh concrete as well as hardened concrete are based on the tests such as workability and mechanical properties, which were performed by using copper slag replaced with sand in concrete as well as normal mix concrete.

4.1.1 SLUMP FLOW TEST

It is the most commonly used test, and gives a good assessment of filling ability. It gives no indication of the ability of the concrete to pass between reinforcement without booking, but may give some indication of resistance to segregation.

4.1.2 V-FUNNEL TEST

This is a widely used test, suitable for laboratory and perhaps Filling site use. It asses filling and passing ability of SCC, and serious lack of stability can be detected visually.

4.1.3 L-BOX TEST

This is a widely used test, suitable for laboratory and perhaps Filling site use. It asses filling and passing ability of SCC, and serious lack of stability can be detected visually.

TABLE 4.1 SCC TEST RESULTS

S.No	SCC test method	Observed value for 1% dosage of super plasticizer					
		Nominal concrete	Aramid fiber %				
			0.05	0.10	0.15	0.20	0.25
1.	Slum flow test	670mm in 3.3s	650 mm in 3s	630 mm in 4s	610 mm in 3.5s	605 mm in 3s	603 mm in 3.2s
2.	L-Box test	0.93	0.9	0.8	0.85	0.86	0.87
3.	V-Funnel test	9s	8s	10s	9s	10s	11s

V. EXPERIMENTAL PROGRAMME

5.1 DESCRIPTION OF SPECIMEN

This experimental program includes six specimens. Control concrete specimen was named as C and concrete specimens with various proportions of waste plastic were named as Sp1, Sp2, Sp3, Sp4 and Sp5. Table 5.1 shows various percentage of waste paper sludge ash replace the cement in concrete.

5.2 CASTING AND TESTING

- Using IS method of mix design, the concrete mix was designed for M30.
- The mix proportion is 1:1.76:1.70with water cement ratio as 0.42.
- A vertical slump of 120 mm was aimed and it was achieved by adding super plasticizer of 0.5% weight of cement to the normal mix. For M30 grade of concrete.
- The specimens were casted for 150mm x 150mm x 150mm cube, and 150mm diameter with 300mm height cylinder.

TABLE 5.1 EXPERIMENTAL PROGRAMME

S.NO	Identification of Specimen	% of Fiber added	No. of cubes and cylinder	
			7th day	28th day
1.	Control	0	3	3
2.	SP 1	0.05	3	3
3.	SP 2	0.10	3	3
4.	SP 3	0.15	3	3
5.	SP 4	0.20	3	3
6.	SP 5	0.25	3	3

VI. RESULT AND DISCUSSION

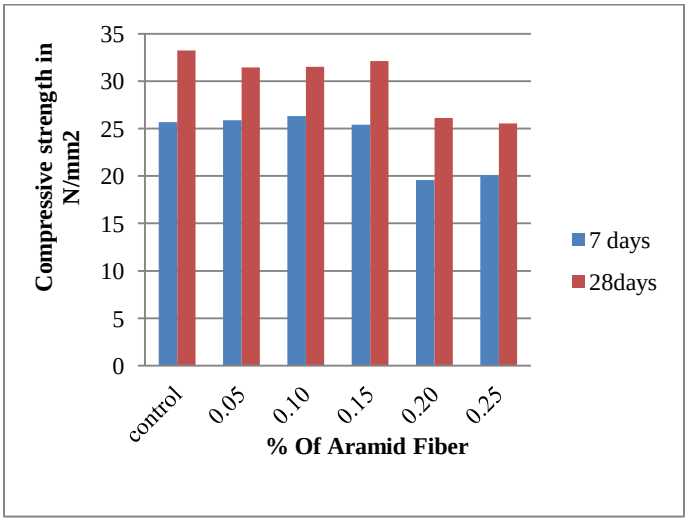
6.1 COMPRESSIVE STRENGTH TEST

Compression test on concrete cubes has been carried out confirming to IS 516-1999. All the concrete cube specimens were tested in a 2000KN capacity compression testing machine. The crushing strength of concrete cube is determined by applying compressive load at the rate 140 kgf/cm^2/min or 140 KN/min till the specimen fail. After 28 days of curing, the cubes were then allowed to become dry for few hours before testing. Cubes were tested on 7th and 28th days. Plane surfaces of the specimen were between plates of compression testing machine and subjected to compression loading. Three cubes are tested for each specimen and average values are taken. The compressive strength of the concrete cubes on 7th and 28th days are given in Table 6.1.

Compressive strength of cube = Load / Area

TABLE 6.1 COMPRESSION STRENGTH TEST

S.NO	Identification of Specimen	% of Fiber added	No. of cubes and cylinder	
			7th day	28th day
1.	Control	0	25.67	33.23
2.	SP 1	0.05	25.89	31.43
3.	SP 2	0.10	25.32	31.42
4.	SP 3	0.15	25.41	30.11
5.	SP 4	0.20	19.57	24.13
6.	SP 5	0.25	18.07	22.55



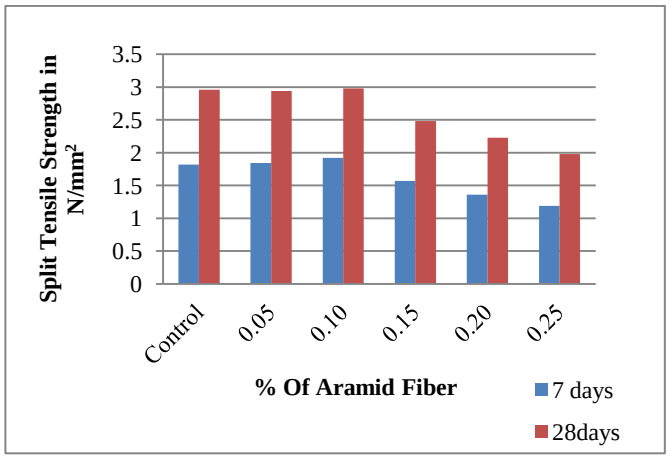
6.2 TENSILE STRENGTH TEST

Splitting tensile strength test on concrete cylinder is a method to determine the tensile strength of concrete. The concrete is very weak in tension due to its brittle nature and is not expected to resist the direct tension. The concrete develops cracks when subjected to tensile forces. Thus, it is necessary to determine the tensile strength of concrete to determine the load at which the concrete members may crack.

The split tensile strength of Cylinder $T_{sp} = \frac{2p}{\pi DL}$

TABLE 6.2 SPLIT TENSILE STRENGTH TEST

S.NO	Identification of Specimen	% of Fiber added	No. of cubes and cylinder	
			7th day	28th day
1.	Control	0	1.82	2.96
2.	SP 1	0.05	1.84	2.94
3.	SP 2	0.10	1.57	2.48
4.	SP 3	0.15	1.92	2.38
5.	SP 4	0.20	1.36	1.98
6.	SP 5	0.25	1.19	1.48



VII. CONCLUSION

The following conclusion have been made from the above experimental study

- From the test results of self compacting concrete, it has been found that the all the mixes achieved the designed characteristic strength of M30 grade.
- It is observed that the compressive strength, Split tensile strength are on higher side for 0.15 % fibers
- It is observed that compressive strength increases upto 0.15% and it will decreases above 0.15% with addition of aramid fiber.
- It is observed that split tensile strength increases upto 0.15% and it will decreases above 0.15% with addition of aramid fiber.

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Experimental Study on Cellular Lightweight Concrete Block (CLC Block)

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Abstract*—This paper represents the effect on the strength of CLC Block. CLC block manufacturing uses Cement, fly ash, water and foam Agent ash as Raw Material. Gains strength with age like concrete. Pollution free, no primary energy consumption. Any size, shape can be given by mould /cut. CLC is light weight block where water absorption is less than compared to red brick blocks and density is 800 kg/ m3. More advantages are involved in CLC block specimen that is thermal conductivity, fire Protection, reduction of dead load, enhances carpet area, surface finish, eco-friendly, speedier constructions, ease of work ability, universal acceptability, low water absorption, ideal material for applications in cold storage rooms, longer service life ,design flexibility, easy handling, compressive strength is more than other bricks, life span is more than other bricks, accurate size and shapes help in reducing plastering costs.*

Keywords*—*Fly ash, Cement, Sand, Foaming Agent, Concrete Block

I. INTRODUCTION

This world is changing day by day. Technologies are also changed with time. Technological advancement leads business process in all new different dimensions. Country like India is growing rapidly. Infrastructure Development is in big bane. Development forms and methods are also changed due to change in technology. In case of a conventional construction of a building or any structure, the main source of raw material is Sand bricks or Stones or wooden sheets as a wall. The new concept for making wall has been developed that is

Cellular Light weight Concrete (CLC) Bricks. It is a light weight, water resistant, fire- proof, sound proof and environment friendly. The main feature of this bricks is light in weight. Cellular Lightweight Concrete bricks are made of fly ash, cement, and foaming agent. These can be extensively used in all building constructional activities similar to that of common burnt clay bricks. The CLC bricks are comparatively lighter in weight and stronger than common clay bricks. Since fly ash is being accumulated as waste material in large quantity near thermal power plants and creating serious environmental pollution problems, its utilization as main raw material in the manufacture of bricks will not only create ample opportunities for its proper and useful disposal but also help in environmental pollution control to a greater extent in the surrounding areas of power plants. In view of superior quality and eco-friendly nature, and government support the demand for CLC Bricks has picked up.

A majority of the CLC products are compact in size thereby it takes very fewer space. This also contains lesser production capacity. Nevertheless, the completed products need a good number of spaces for curing. These types of bricks may hardly be built up along with each other. For that reason it requires a lot more space for accommodation.

II. MATERIALS USED

A. Cement

53 grade ordinary Portland cement (OPC) is used for manufacturing CLC bricks. It will give faster strength to the bricks, besides giving improved consistent quality. It also ensures a better cost effectiveness for the same. Using OPC will be a standardized practice. The other prime advantage of using OPC (compared to other binders) is it's easy availability locally through nationwide Retail Network of Cement Companies.

B. Water

Water is the most important constituent of a concrete mass which enables bonding between cementitious materials and the aggregates. A part of mixing water is utilized in the hydration of cement to form binding matrix in which the inert aggregates are held in suspension until the matrix has harden. The remaining water serves as a lubricant between the fine and coarse aggregate and makes concrete workable. Water Hardness maximum 100 PPM Need Industrial softer for hard water

C. Fly Ash

We should use fine fly ash (may be use pond ash), which is available in thermal power plants. (It is also available in certain industries free of cost. There are no taxes on this item whatsoever. Transportation charges are only to be attended by the entrepreneur. This raw material is one hundred percent (100%) suitable for CLC bricks production.

1) *Physical Properties*
Specific Gravity 2.54 to 2.65 gm/cc

Bulk Density 1.12 gm/cc

2) Chemical Properties

Silica	35-59 %
Alumina	23-33%
Calcium Oxide	10-16%
Loss on ignition	1-2%
Sulphur	0.5- 1.5%
Iron	0.5- 2.0 %

D. Foaming Agent (Chemical)

Foaming agent is fully biodegradable protein-based foam concentrate that forms stable bubbles and provides necessary porosity to the foam concrete. The bubbles formed are strong enough to last until the concrete is set at required density. 40-80 gms per Liter – Foam Density. Foaming agent is easily available in the market. Protein foaming agent (veg) can be used for roof insulations.

A. Specification:

- Physical appearance: Light Yellow Translucent liquid
- Specific Gravity: 1.0-1.05
- pH: >7.5
- Chloride Content: <0.10%

E. Fine Aggregate

Those fractions from 4.75 mm to 150 micron are termed as fine aggregate. The river sand is used as fine aggregate conforming to the requirements of IS: 383-1970. Sieve analysis was done using standard sieve analysis procedure and the sand conforms to Zone II.

III. Equipments Details

A. Foam Generator

Foam generator comes with fully automated System, Timer with high quality of imported Motor. It produces high quality of Foam With customized and large output Production.

1) Specification:

- 3 Digit timer relay
- Two pole MCCB
- LED Automatic ON/OFF Switch
- 1 hp single phase motor
- Comes with emergency switch
- Production Capacity: 600 ltrs foam Out Put / min
- Timer : Automatic timer System
- Weight : 60 kgs

B. CLC Mixer Machine

CLC mixer machine is a ribbon type blender capacity range in between 15 cubic meters to 150 cubic meters. In this machine we can produce high quality of CLC blocks at required density. In this we are using high quality of materials like gear box and motor 15 m3 : 5 hp Gear Box / Motor.

- 30 m3 : 7.5 hp Gear Box / Motor
- 50 m3 : 10 hp Gear Box / Motor
- 100 m3 : 20 hp Gear Box / Motor
- 150 m3 : 30 hp Gear Box / Motor

C. CLC Plant

Two types of CLC Plant are available. Water Curing and Steam Curing. Water Curing is best one. Because the Investment is very less and it is suitable for Builders, Building Material Suppliers, Clay Brick, Fly Ash Brick, Concrete Brick Manufacturers.

D. CLC Pump

It is a Slurry Pump Used to Pump the Material from 30 meters to 100 meters as per the requirement 3 hp to 10 hp motor.

E. CLC Mobile Unit

CLC Mobile Unit is the Movable Type Machine. We Can Directly Take The Machine To The Construction Site. Production Capacity From 15 m3 to 100 m3

F. CLC Moulds

Two types of CLC Moulds are available

A. Battery Moulds

Battery Moulds are Adjustable Moulds for various sizes in single mould we can adjust our required sizes of Blocks. In 1 Mould We Get 10/15/20 Blocks as Per our Requirement.

B. Vertical Moulds

Vertical Moulds are also Size adjustable Moulds We Can Adjust Required Sizes of the Blocks. The Capacity Of Vertical Mould Is 1m3

G. Steam Curing

This is suitable for higher production capacities. We get high Production in very quick time. Production capacity from 15 m^3 to 150 m^3.

H. Foam Concrete Machine

Foam Concrete Machine also Known as CLC Machine. In This We Can Make Foam Concrete Blocks Otherwise We Can Pour Foam Concrete Directly For Compound Wall, Floorings etc . Without making block capacity range from 15 m3 to 150 m3.

I. Foaming Agent

It Is an anti Foaming agent. In this Two Types are available Synthetic Based and Protein Based

1) Synthetic Based

- It Is Purely Natural Based Foaming agent

2) Protein Based

- It is an animal Based foaming agent taken from animals.

J. Trolleys

Two Types Of Trolleys are available

- Material Trolley
- Block Trolley

1) Material Trolley

Material Trolley used to Carry the Materials From Mixer Machine to Pour in to the Moulds. Capacity 200 ltrs.

2) Block Trolley

Block Trolley Used To Carry Blocks From Moulds.

K. CLC Block Size and Details

CLC block size can be cut at any size according to local market needs. The different sizes available in CLC Blocks & its weight are given below.

TABLE 1 Details of Block size

Size in MM	Size in inches	No of Block in one m3 (kg)	Weight (kg)
600 x 200 x 100mm	24 x 8 x 4”	82	10 – 10.5
600 x 200 x 150mm	24 x 8 x 6”	55	15 – 15.5
600 x 200 x 200mm	24 x 8 x 8”	41	20 – 20.5
600 x 200 x 225mm	24 x 8 x 9”	36	25 – 26

GREEN STONE

RELATIVE COMPARISION OF ALTERNATIVE WALLING MATERIALS

S.NO	Parameters	Burnt Cly Bricks	Concrete Hollow Blocks	Lightweight Concrete				
				AAC Aerated Auto Calved		CLC Cellular Lightweight Concrete		
1	Basic raw materials and other inputs	Top agricultural soil, energy	Cement, Sand, Aggregate	Cement, Lime, Sand Gypsum, Aeration Compound		Cement, fly ash, water and foaming compound		
2	Dry Density Kg/M³	1900	1700	650	750	400	800-1000	1200-1800
3	Comp. Strength- Kg/cm²	35-125	30-50 KG/CM²	35	40	20-30	40-60	125-180
4	Usage	Load Bearing and Non-Load bearing	Non - Load bearing walls	Non Load Bearing Blocks	Reinforced Panels	Insulation	Partitions, Low-rise Load Bearing	RCC Elements
5	Water Absorption age weight	15 - 20	-20	-60		15	12.5	7.5-10
6	Pre cast block size	229 x 114 x 70 mm	400 x 200 x 200/100 mm	625 x 250 x 100/200 mm		500 x 250 x 100/200 mm		

Fig 1 Comparision Details

IV. Inspection and Quality Control

The Bureau of Indian Standards has formulated and published the specifications for maintaining quality of product and testing purpose. IS: 12894: 2002. Compressive strength achievable: 60-250 Kg/Cm. Sq. Water absorption: 5 – 12 %; Density: 1.5 gm/cc Co-efficient of softening (depending upon water consistency factor) Unlike conventional clay bricks fly ash bricks have high affinity to cement mortar though it has smooth surface, due to the crystal growth between brick and the cement mortar the joint will become stronger and in due course of time it will become monolithic and the strength will be consistent.

A. Pollution Control

The technology adopted for making fly ash bricks is eco-friendly. It does not require steaming or auto-calving as the bricks are cured by water only. Since firing process is avoided. There are no emissions and no effluent is discharged. Facial masks and dust control equipment may be provided to the employees to avoid dust pollution more over all the raw materials are kept under covered by polythene sheet to avoid air pollution.

V. Results and Discussion

A. Power Consumption

TABLE 2
Power Consumption Required For Running CLC Plant

Sl No	Name of the Machine	No. of machines	H.P Connected
1	1.5 cubic meter mixer	1	7.5
2	Foam generator	1	2.0
3	Compressor	1	2.0
4	Water motor	1	2.0
5	Belt Conveyor	1	2.0
6	Screw Conveyor	1	2.0
7	Cutting Machine	1	5.0
8	Other electrical fittings/ lighting etc	-	2.5
Total			25.0

B. Financial Aspects

TABLE 3 Land & Building

Sl.no	Description	Amount in Rupees
1	Land 1 Acre	3,00,000
2	Building (60 x 40 = 2400 Sq. feet.) x Rs.500	12,00,000
3	Overhead water tank	50,000
4	Office and Security room 300 Sq. Ft	3,00,000
	TOTAL	18,50,000

C. Recurring Expenditure (per month)

TABLE 4 Raw Materials Per Month

Estimates of Raw Material Consumption per m3			
Raw Material	**Qty**	**Rate / per kg**	**Amount in Rupees**
Fly Ash	500 kg	0.80	400.00
Cement	250 kg	8.00	2000.00
Chemical	1.5 kg	150.00	225.00
Water	200 lit	0.05	10.00
Power (KWH)& Fuel	-	-	**20.00**
Labour .	-	-	**200.00**
Total	-	-	**2855.00**
Damages & Miscellaneous @ 2%	-	-	**57.00**
Local Transport	-	-	**200.00**
Others (Marketing the Product)	-	-	**200.00**
Total			**3312.00**

D. Selling Price (Approx)

- 3800 m3 - 3312 = 488 / m3 profit
- 488 X 15m3 =7320 day profit
- 7,320 X 26 = 1,90,320 profit per month for 26 day working
- Per year profit is 1,90,320 X 12 = 22,83,840

- Working Capital Calculation- per day/per Shift 15 m^3
  15 m^3 x 2855 x 90 days = 38, 54,250/-

E. Production Capacity Per Year:

Project having production capacity of 15 cubic mtr per day.So it is assume that plant will run 300 days in year.

- Total capacity range is 15 cubic mtr x 300 days = 4500 cubic mtr

VI. Conclusion

Cement industry globally account for nearly 6.5% of CO^2 emissions. Use of fly-ash would reduce clinker consumption and bring down emission of green house gases in the atmosphere. The increasing awareness and legislation on environmental issues would enable cement industry to use fly ash not only in production of cement but as a constituent in raw-meal in production of clinker wherever possible. The durability of construction especially in aggressive and marine environment will also help in utilization of more fly ash as cementitious material.

- Strength values are increased compared conventional brick
- Reduction in cost of production
- Increase in throughput of cement plant

CLC is light weight block where water absorption is less than compared to red brick blocks and density is 800 kg/ m3

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EVALUATION OF LAND USE AND LAND COVER CHANGE DETECTION FOR AN CITY USING QGIS

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***Abstract*—**

Land use and land cover change detection study over the year 2000-2017 have been carried out for the study area of Oragadam to poonamalle (Kanchipuram District). For this study the Multi Temporal data sets of the years 2000,2010 and 2017 from LANDSAT TM, ETM+ and OLI images of different land use and land cover change have been identified using visual image interpretation techniques. The major part of the study area is covered by Agricultural land which covers about 130.748 sq.km in year 2000,97.373 sq.km in year 2010 and 50.834 sq.km in year 2017;Industrial area which covers about 6.105 sq.km in year 2000,12.183 sq.km in year 2010 and 20.186 sq.km in year 2017;Barren land 16.1782 sq.km in year 2000,38.019 sq.km in year 2010 and 69.805 sq.km in year 2017;Settelement area which covers about 31.144 sq.km in year 2000, 63.843sq.km in year 2010 and 93.748 sq.km in year2017;water body which covers about 31.0177 sq.km in year 2000,50.921 sq.km in year 2010 and 20.190 sq.km in year 2017.The output maps were Analysed and Digitilized. After the analysis of land use and land cover change detection we conclude Agriculture area are reduce and urban areas are Increased..

Keyword—QGIS9.3,Kanchipuramdistrict,GIS,Land use,Land cover,Remote sensing.

I. INTRODUCTION

Land use land cover change detection analysis is essential for planners to understand land use changes in urban areas for planning sustainable development. With the dynamic urbanization and industrialization process, there is an increasing pressure on land, water and environment causing pollution, traffic congestion, and infrastructure pressure, rising taxes and neighborhood conflicts particularly in the metropolitan cities. Urban sprawl is the scattering of new development on isolated tracts, separated from other areas by vacant land. Urban extend has been criticized for inefficient use of land resources and large encroachment onto the agricultural lands. Due to the large scale urban extend, the cities are expanding in all directions with changes in land use pattern.

Remote sensing has great potential to study land use and land cover changes Nowadays high resolution spatial imagery are available from satellite like worldview. An important part of land use and land cover change is to obtain information about the geometric elements of different classes.

II OBJECTIVES OF THE STUDY:

- To identify the spatial and temporal pattern land use and land cover change using Remote sensing and GIS
- To identify driving factors of urban growth using satellite images for different years.

- To validate the urban development of the study area using change detection analysis.

III LITERATURE REVIEW

Evaluation of Land Use and Land Cover Changed Detection Using RS & GIS A Model Study From Vijayawada,AP (Arjun dhakal) how to prepare the Land use and land cover change has become a central component in current strategies for managing natural resources and monitoring environmental changes. Urban expansion has brought serious losses of agriculture land, shrub, barren land and water bodies.In this project an attempt is made to study the changes in land use and land cover in Vijayawada region over period of time i.e. from 2002 to 2012.the study has been done through remote sensing approach using land sat imageries of this region.

Application of land change modeler for prediction of future land use land cover for Vijayawada city (k.sundara kumar) how to predict and analyse the present and future growth of vijayawada city of the year 1973,2001,2014. to predict the land use and land cover images of 2030 to 2040 of using terrset software..A total area 85515.75 hectares was taken as study area which has potencial for expansion. Prediction of future lulc image will be helpful for proper planning of urban environmental management.an accuracy of more than 80% was obtained in all stages. the output images were analysed and presented.

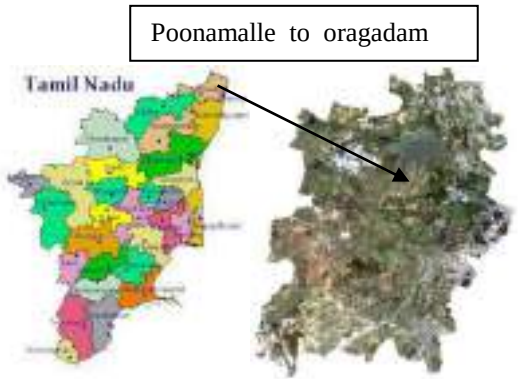
Land use and land cover change detection study over the year 1990-2001 have been carried out for the study area of usilampatti block in Madurai district.(Pradeep.c)discuss this paper to predict and analyse the present and future growth of USILAMPATTI BLOCK of the year 1990,2001 This data can be recorded and can be compared with future data to find out the impact of humans on the natural environment and natural changes.the finding are major part of the study area is agricultural land, which covers about 86.5 sq.km in 1990 and 67.288sq.km in2001;wasteland covers about 68.371sq.km in 1990 and 76.233 sq.km in 2001 build up covers about 1.976sq.km in 1990 and 2.68sq.km in 2001.Thus the output images were analysed and presented.

Dhanasekarapandian.MSelvan.p,chandran.s,chandra mohan have discussed about the change of land use and land cover using quantitative method to expound the impact of land use and land cover in Giruthumalriver sub basin from a period of year 1990 to 2010.To analyse the dynamic nature location and magnitude of changes within the land use classes for the period 1990 to 2010The result of poor irrigation facility and could not be regular monitoring of land activities the satellite images of study area acquired during 1990 to 2010 periods have offered a rich source of information about land use and land cover change detecting and assessing.land use changes have been detected by image processing method in ERDAS imagine 8.5 and Arc GIS 9.3.Thirteen land use classes have been identified and growth truth observation was also performed to check the accuracy of the classification.the present study has brought to light that the agricultural land that occupied about 29.86% of basin area in 1990 and was decreased to 18.13% of basin area in 2010 and settelement increased 9.8% of total area of basin in 2010.

Identification and monitoring the change of land use pattern using remote sensing and GIS (Asif mahmood) have discussed how to predict and Analyse the present and future growth of Dhaka city of the year 1990,2003,2010. This data can be recorded and can be compared with future data to find out the impact of humans on the natural environment and natural changes. the output images were analysed and presented.the remotely detected land use and land cover change from 1990 to 2010 shows that Dhaka is gradually changing as vegetative cover and open spaces have been transformed into buildings areas,low land and water bodies into reclaimed build up lands. These changes are mainly governed by unplanned urban expansion.this paper presents an integrated study of urbanization trends in Dhaka city.dhaka is a sheer examble of having poor legislative actions inefficient management and lack of public awareness which leads the urbanization to an unplanned and resource consuming development.

IV DESCRIPTION OF STUDY AREA

The study area is chosen based on the preliminary investigation of growth patterns in Chennai Metropolitan Area (CMA). The study area is located in the periphery of Chennai city which has rapid urban development resulting large land use change in the last decade due to the development activities in the area and Oragadam, Sriperumbudur taluk of Kanchipuram district is a fastest growing suburb in Chennai metropolitan area. It is located in the strategic location between NH45 and NH4. It is also known as the biggest automobile hub in south asia. Poonamalle is a fastest developed area with a population of 57,224(2011 census).



III DATA AND METHODOLOGY

3.1 Data Collection

This research is dependent on secondary data. To prepare the base maps for analysis purpose and applying the different methods to achieve the study objectives, Landsat satellite images (2000, 2010 and 2017) have been collected from *Knchipuram Space Research & Remote Sensing Organization* (*SPARSO*). Table shows the details of the Landsat satellite images used for analysis from Land sat-5,Land sat -7 ETM+, Land sat -5-TM.Map Projection of the collected satellite images is Universal Transverse Mercator (UTM) within Zone 46 N–Datum and of the co-ordinate system World Geodetic System (WGS) 84 and the pixel size is 30 meters.

3.2 DATA PREPARATION

The collected images are pre-processed by radiometric or geometric corrections. Radiometric corrections include correcting the data for sensor irregularities and unwanted sensor or atmospheric noise, and converting the data so they accurately represent the reflected or emitted radiation measured by the sensor.

Image enhancement is solely to improve the appearance of the imagery to assist in visual interpretation and analysis. Contrast stretching has been performed to increase the tonal distinction between various features in a scene, and spatial filtering to enhance (or suppress) specific spatial patterns in an image. Arithmetic operations (i.e. subtraction, addition, multiplication, division) are performed to combine and transform the original bands into "new" images which better display or highlight certain features in the scene. The image pre-processing, enhancement and transformation operations are done using Arc GIS 10.2.

3.3 LAND USE / LAND COVER CLASSIFICATION

Using the basic colors red, green and blue (RGB), it is possible to prepare different images. To distinguish between different cover types or ground objects like buildings, roads, and vegetation, these images are useful. We have choose the FCC of RGB= bands 4, 3 and 2 for this study. This combination normally makes built-up areas appear blue, vegetation red, water bodies from dark blue to black, soils with no vegetation from white to brown.

Image classification refers to grouping image pixels into categories or classes to produce a thematic representation. Image classification comprehends various operations that can be applied to photographic or image data. These include image restoration, image pre-processing, enhancement, compression, spatial filtering, and pattern recognition and so on. There are two basic methods of image classification: supervised and unsupervised. Supervised classification relies on the priori knowledge of the study area. Therefore, for this study, a supervised classification method has been used.

3.4 IMAGE CLASSIFICATION

After developing training samples for all land cover classes the next step is to classify the images based on these training samples. This has been done using the Interactive Supervised Classification Toolbar in Q GIS 9.3. This latest version of ArcGIS enables us to perform the land cover classification without creating any signature files, which was primitive for the older versions.

Land use/cover types	Description
Water bodies and Wetlands	River, permanent open water, lakes, ponds and reservoirs ;Permanent and seasonal wetlands, marshy land, rills and gully, swamps
Built-up	Residential, commercial and services, industrial, transportation, roads, mixed urban, and other urban
Vegetation and cultivated	Deciduous forest, mixed forest lands, palms, conifer, scrub and others Crop
land	Fields, Fallow lands and vegetable lands
Bare soil/Exposed soil	Exposed soils, sand fill, landfill sites, and areas of active excavation

3.5 Generalization

Sometimes many isolated pixels may be found after image classification . These isolated pixels belong to one or more classes that differ from surrounding pixels. Therefore it is necessary to generalize the image and remove the isolated pixels. Filtering is the solution for this type of problem. After a vector-to-raster conversion, mode filters are good for filling gaps between polygons. Therefore, a 3×3 mode filter has been applied to generalize the supervised

classified land cover images. This post-processing operation replaces the isolated pixels to the most common neighboring class. Finally the generalized image is reclassified to produce the final version of land cover maps for 2000, 2010 and 2017.

3.6 Image pre-processing

The set of Landsat ETM+ data were initially geo-corrected and rectified. The whole scene sizes of the satellite imagery of ETM+ data were cropped to the study area. The study area includes Chennai city administrative area and a 10km buffer from the city boundary. The final subset imagery of the study area was obtained using ENVI Imagine for further classification Of all the various data sources used in GIS, one of the most important is undoubtedly that provided by remote sensing. Through the use of satellites, we now have a continuing program of data acquisition for the entire world with time frames ranging from a couple of weeks to a matter of hours. Very importantly, we also now have access to remotely sensed images in digital form, allowing rapid integration of the results of remote sensing analysis into a GIS The development of digital techniques for the restoration, enhancement and computer-assisted interpretation of remotely sensed images initially proceeded independently and somewhat ahead of GIS. However, the raster data structure and many of the procedures involved in these *Image Processing Systems* (IPS) were identical to those involved in raster GIS. As a result, it has become common to see IPS software packages add general capabilities for GIS, and GIS software systems add at least a fundamental suite of IPS tools. IDRISI is a combined GIS and image processing system that offers advanced capabilities in both areas.

3.7 Landuse

The Landuse of the study area were interpreted from satellite images using GIS, which consisted of differentclasses.Landuse with consistent classification for two time periods is needed for the calibration of model. Input data for the study area prepared as a subset of main image. The collected images are pre-processed by radiometric or geometric corrections.radiometric corrections include correcting the data for sensor irregularities and unwanted sensor or Admospheric noise and converting the data so they accurately represent the reflected or emitted radiation measured by the sensor. Image enhancement is solely to improve the appearance of the imagery to assist in visual interpretation and Analysis.contrast stretching has been performed to increase the tonal distinction between various features in a scene and spatial filtering to enhance specific spatial patterns in and Image.Arthmeticoperations(Addition,subtraction,multiplication,Division)areperforme to combine and transform the original bands into new images which better display are certain feautures in scene.the image preprocessing enhancement and transformation operations are done using QGIS 9.3.

3.8 Excluded areas

Exclusion is defined as areas which are resistant to urbanization.Excluded area chosen for this analysis includes water bodies of tanks and canals. These areas are mainly extracted from the classified land cover data.

3.9 Urban extent

Satellite imageries of the study area for the year 2000, 2017 and have geo referenced using Arc GIS. Landsat images of resolution 30m and 15m was used for on-screen digitization of the extent of built structures.

3.10 Population density

The population data were collected from census of India for 2000, 2010 and 2017. The density maps were prepared using population data and urban map in Arc GIS. Table 3.2 represents the village population census.

TABLE 3.2 POPULATION CENSUS DATA

	POPULATION				POPULATION		
VILLAGE NAME	2000	2010	2017	VILLAGE NAME	2000	2010	2017
Alagpoor	127	286	302	Navalur	629	758	3539
Amarambedu	376	894	1187	Neelamangalam	675	1042	1575
Ammanumbakkam	40	85	390	Oddankaranai	521	610	323
Arambakkam	390	513	1242	Oragadam	658	822	1985
Athanancheri	1239	2334	3668	Orathur	1124	1549	1744
Ayyancher	467	820	1121	Padappai	6713	8185	14068
Chembarambakkam	819	878	1505	Panapakkam	103	143	458
Erumaiyur	618	2047	2379	Pazhanthandalam	2961	3359	4777
Gunduperumbedu	389	566	1020	Peerkankaranai	10986	17511	25871
Irumbedu	239	308	323	Perinalur	1163	1604	2610
Irungattukottai	1219	1439	3904	Perinjambakkam	231	398	1379
Kadaperi	5758	93	157	Perungalathur	12376	19594	37342
Kaduvancheri	349	405	484	Pillaipakkam	1093	1747	1741
Kanchivakkam	398	479	644	Ponnamallee	28832	42612	64213
Karanaithangal	97	122	182	Ponnthandalam	568	1009	9117
Karasangal	1980	2215	3858	Puduchen	239	336	815
Katrambakkam	1177	1453	2157	Puduppair	458	551	788
Kavalkazhani	38	53	140	Pulikaradu	219	345	325
Kavanur	1009	2304	1586	Salamangalam	1127	1119	2547
Keelakal	107	142	281	Serapanancheri	734	866	976

Kilambakkam	6791	18455	26865	Sethupattu	658	809	1027
Kollathur	686	985	1374	Sikkarayapuram	7230	8763	10187
Kollichen	1979	2089	5793	Sirukalathur	1285	2348	6117
Konalkanthangal	678	737	935	Sirumathur	782	879	1084
Kovur	3086	5648	10961	Somangalam	2998	3569	4376
Kozhumanivakkam	644	1260	2720	Tamboram	19687	25694	383718
Kundrathur(TP)	25137	27128	42126	Thandalam	2074	2680	5546
Madambagam	123	562	828	Thirumudivakkam	1264	3027	4083
Mahanyam	798	835	1860	Thiruneermalai(TP)	14569	18218	30702
Malaipattu	810	883	1078	Thundalakani	973	1122	781
Malayambakkam	3598	5025	8250	Tirunageswaram	567	652	821
Mangadu	11235	22127	38188	Tukkanampakkam	2084	2884	3475
Manimangalam	4872	5163	8398	Urapakkam	9693	13445	29122
Manivakkam	2844	9788	13808	Vaipoor	1003	1816	1803
Mathur	453	732	1628	Valarpuram	1361	1965	2360
Mevalurkuppam	5134	4230	5798	Vandalur(CT)	5767	13375	16852
Mudichur	2350	3673	15438	Varadarajapuram	474	1973	5846
Naduveerampattu	2594	4517	6291	Vattambakkam	413	560	663
Nallamperumbedu	43	85	168	Vellarai	230	379	426
Nallur	779	741	4618	Vellerithangal	84	108	185
Nandambakkam	1782	9343	11239	Vengadu	721	999	1011
Nandivaram	21874	26576	44088	Venjuvancheri	330	406	649
Nariyambakkam	376	412	566	Venkatapuram	928	1210	2137

RESULTS AND DISCUSSION

4.1 INTRODUTION

The quality of the input data and the selection of optimal parameter ranges should be considered carefully to improve the calibration result. The calibration process has resulted in the determination of a set of land use and land cover change to quite accurately simulate the observed growth in the study area.

4.2 LANDUSE

Landuse map is prepared by onscreen visual interpretation of satellite map. The NRSC level II classification is adopted for mapping. A Landuse interpretation key for Agricultural land, urban area, barren land, forest area, dense scrub, scrub land and water body classes were used for Landuse map preparation.

Fig 4.1, 4.2 and 4.3 for the year of 2000, 2010 and 2017.

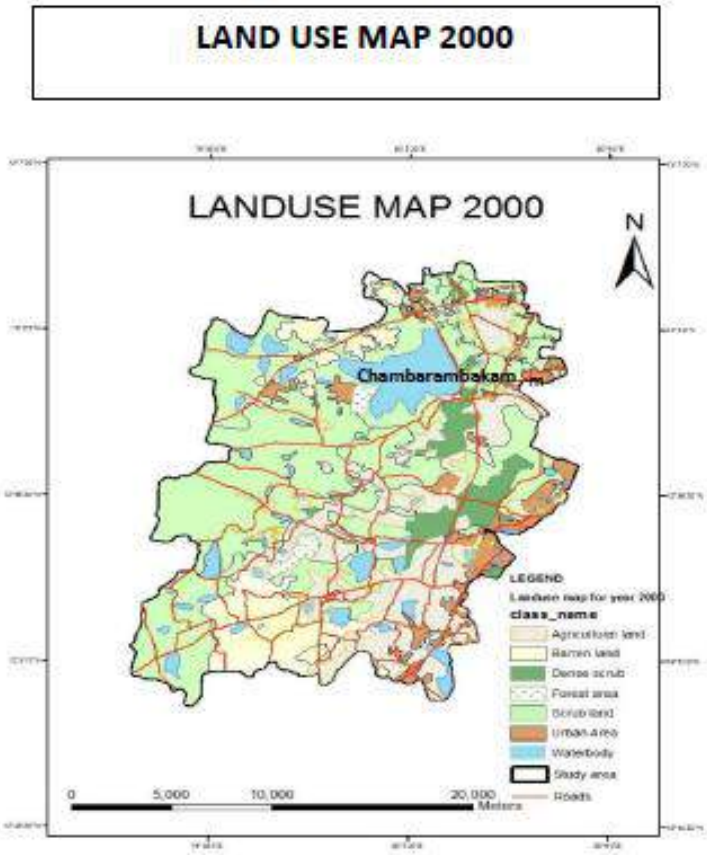


Fig 4.1 Landuse map of the study area in the year of 2000

DESCRIPTION	AREA IN Sq.kms
AGRICULTURE LAND	130.74834
INDUSTRIAL AREA	6.10571
BARREN LAND	16.1782
SETTELEMENT	31.144485
WATER BODY	31.017724

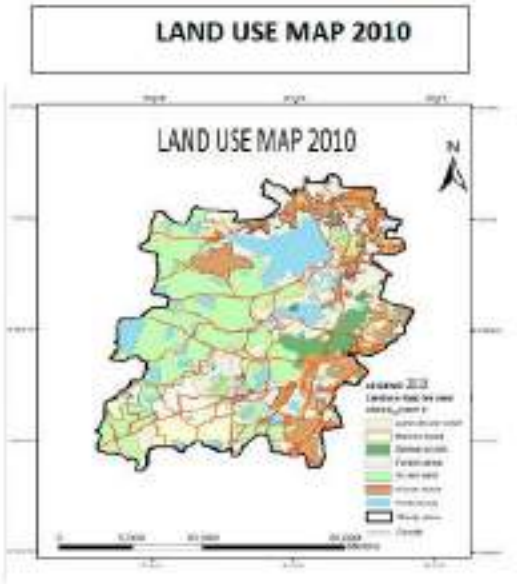


Fig 4.2 Land use map of the study area in the year of 2010

DESCRIPTION	AREA IN Sq.kms
AGRICULTURE LAND	97.373152
INDUSTRIAL AREA	12.383452
BARREN LAND	38.019873
SETTELMENT	63.84378
WATER BODY	50.921662

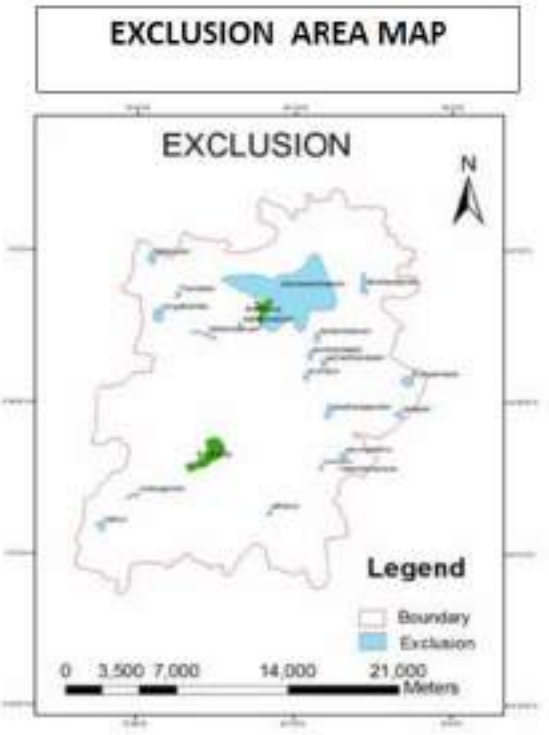


Fig: 4.4 Excluded area of the study area

Fig: 4.3 Land use map of the study area in the year of 2017

DESCRIPTION	AREA IN Sq.kms
AGRICULTURE LAND	
INDUSTRIAL AREA	
BARREN LAND	
SETTLEMENT	
WATER BODY	

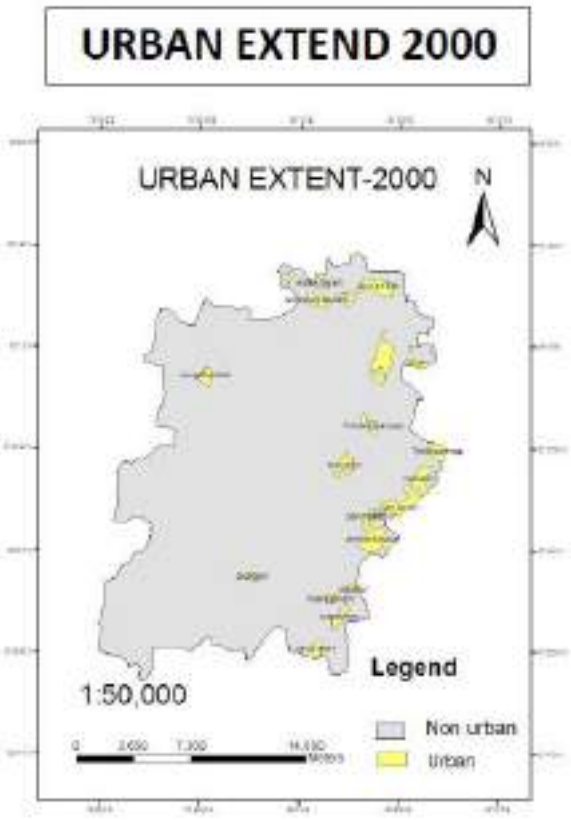


Fig: 4.5 Urban extent area of the study area 2000

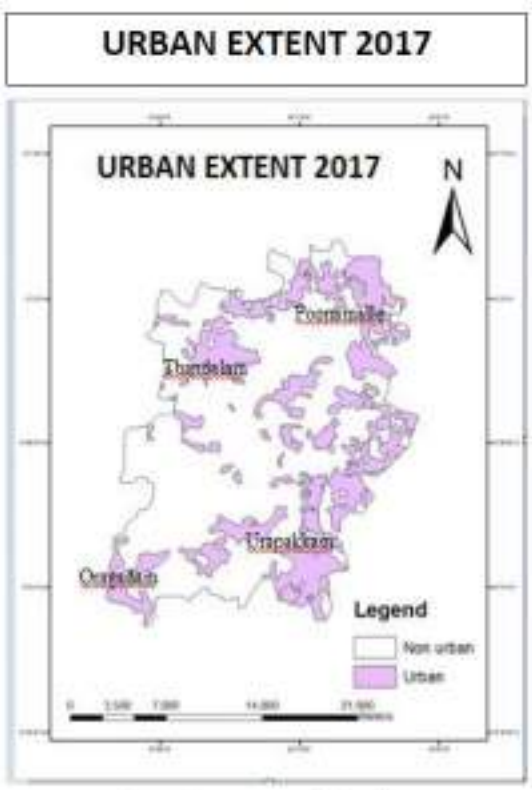
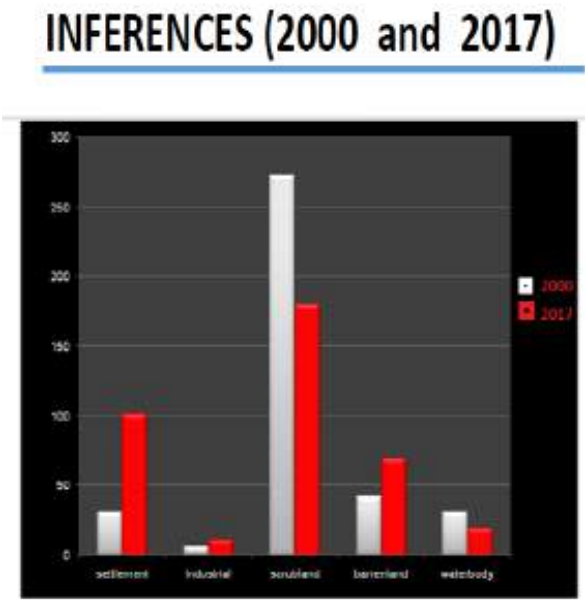


Fig: 4.6 Urban extent area of the study area 2017



V CONCLUSION

Land use and land cover classification of oragadam to poonamalle area of kanchipuram district using remote sensing and GIS was described in the study. landsat images of oragadam to poonamalle area of kanchipuram district of year 2000, 2010, 2017 are analyzed by moderately accurate interactive supervised classification toolbar in Q gis9.3. And various land feautures are delineated, compiled and prepared. The areas of each class were estimated and finally general land use maps for both 2000, 2010,2017 data were prepared. Remote sensing has changed the way of resource evolution studies with the use of multi temporal satellite data it has become increasingly possible to monitor the state of the resource and land use and land cover changes has been successfully monitored. In the present study various resources were identified in which the agricultural area is the predominant land use, since most of the build ups are rural settelements. By proper management of irrigation systems agricultural areas can be increased check dams can be build in the foothills to preserve water so that the ground water level will increase in those area. This will directly help in agricultural production. Government can conduct awareness programs with the help of NGOs to the local villagers in order to develop the waste lands in to usable agricultural lands. The agricultural areas need more and immediate attention since 70% of the country's population depends.

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Partial Replacement Of Cement With Marble Dust And Fly Ash

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ABSTRACT

Since last few years marble is considered one of the most important decorative building materials. Marble powder is one of the materials which affect the environment and health problems. It is produced from sawing, shaping, and polishing process. This Paper aims to study the effect of using marble dust & Fly ash as partially replace with cement on different ratio of concrete .The main variable taken into consideration is the percentage of marble dust and fly ash as partial replacement of cement content in concrete mixes. Leaving the waste materials to the environment directly can cause environmental problem. Hence the reuse of waste material has been emphasized. Waste can be used to produce new products or can be used as admixtures so that natural resources are used more efficiently and the environment is protected from waste deposits. Marble stone industry generates both solid waste and stone slurry. Fly ash is produced in thermal industries.

This research work describes the feasibility of using the marble dust and thermal industry waste in concrete production as partial replacement of cement. The use of marble dust and fly ash in concrete formulations as a supplementary cementations material was tested as an alternative to traditional concrete. The cement has been replaced by marble dust and fly ash accordingly in the range of 0% (without marble dust and fly ash), 5%, 10%, 15% & 20% by weight of cement for M-25 mix. Concrete mixtures were produced, tested and compared in terms of compressive with the conventional concrete. These tests were carried out to evaluate the mechanical properties for the test results for compressive strength up to 28 days are taken.

Keywords—FLY ASH, MARBLE DUST, CEMENT, FINE AGGREGATE, COARSE AGGREGATE.

I. INTRODUCTION

Concrete is widely used construction material consisting of cementing material, fine aggregates, coarse aggregates and required quantity of water. The Marble dust is waste product obtained while cutting the marble blocks. The Fly Ash is also a waste obtained from industries. This will help to use the industrial waste product and contributes in ecofriendly construction.

In Civil Engineering “Cement” plays the important role as it is impossible to produce any sustainable infrastructure without use of cement. We can say everything is incomplete without “Cement”, as construction industry is rapidly growing with new innovations and ideas. Traditionally, we use only cement in concrete for giving the strength to concrete but sometimes it is not possible to reach the exact strength, so that after a long and continue research pozzolanic materials get introduced to the world. Pozzolans are commonly used as an addition to Portland cement concrete mixtures to increase the long-term strength and other material properties of Portland cement concrete, in some cases reduce the material cost of concrete. Pozzolanic materials can be divided into two-groups‟ natural pozzolana and artificial pozzolana. Fly ash is used extensively as a partial replacement of cement. However, though the inclusion of fly ash in concrete gives many benefits, such inclusion causes a significant reduction in early strength due to the relatively slow hydration of fly ash. Nevertheless, fly ash causes an increase in workability of concrete. Quarry dust has been proposed as an alternative to river sand that gives additional benefit to concrete. Quarry dust is known to increase the strength of concrete over concrete made with equal quantities of river sand, but it causes a reduction in the workability of concrete. In this paper fly ash replaced by cement by 0%, 5%, 10%,15%,20% and 25%. The marble dust& fly ash replaced by cement by 0%, 5% , 10%, 15%, 20%.

II. MATERIALS

A. *Cement*

The ordinary Portland cement confirming to IS 4031 was used for the preparation of specimens. OPC 53 grade was used.

B. *Fine aggregate*

Fine aggregate is used in the experimental investigation and confirming to zone-II of IS 383-1970.Sand is used in the work which has the particle was less than 4.75mm.

C. Coarse aggregate

The coarse aggregate particles passing through 20mm and retained on 12.5 mm I.S Sieve used as the natural aggregate which met the grading requirement of IS 383-1970.

D. Water

Water is the most important and least expensive ingredient of concrete. A part of mixing water is utilized in the hydration of cement to form binding matrix in which the inert aggregates are held in suspension until the matrix has harden. The remaining water serves as a lubricant between the fine and coarse aggregate and makes concrete workable.

E. Marble dust

Crushed or powdered marble, sometimes used as a basic carbonate, and frequently used in art as an inert pigment, in the plaster used in frescos, in surface coatings, etc.

Fig 1- Marble dust

F. Fly ash

The ash produced at thermal power stations by burning of coal and lignite is known as fly ash.

III. Material Properties

A. Cement - Opc 53 grade

- Specific gravity -3.16
- Fineness modulus -3%
- Consistency -32%
- Initial setting time-35 mins
- Final setting time -10Hours

B. Fine aggregate

- Specific gravity -2.5
- Fineness modulus -5.27
- Water absorption 0.85%
- Bulk density-1782.46kg/m^3

C. Coarse aggregate

- Specific gravity -2.6%
- Fineness modulus -5.7
- Water absorption 0.56%
- Bulk density-1693.46kg/m^3
- Impact test -17.72%

D. Marble dust

TABLE I - Chemical composition of marble dust

COMPONENT	WEIGHT OF %
Cao	68.6
Mgo	22.13
Sio_2	3.89
Al_2o_3	2.785
Fe_2o_3	0.603
Cr_2o_3	0.24
Zno	0.20
Tio	0.549

E. Fly ash

TABLE II: Chemical composition of FLY ASH

COMPONENTS	WEIGHT OF %
Sio_2	59
Al_2o_3	21
Fe_2o_3	3.70
Cao	6.90
Mgo	1.40
So_3	1.00
K_2o	0.90
Loi	4.62

TABLE III: Mix design

Grade of concrete –M25

Water	Cement	Fine Aggregate	Coarse Aggregate
197.16	438.13	506.74	1206
0.45	1	1.15	2.7

For quantity of materials taken by per meter cube size mix proportions are given below table IV

TABLE IV: Mix Proportions

Mix ID	Cement (kg/m^3)	Fine agg. kg/m^3	Coarse agg. (kg/m^3)	Marble dust (kg/m^3)	Fly ASH (kg/m^3)
CC (0%)	5.4	6.6	14.7	0	0
5%	5.130	6.6	14.7	135	135
10%	4.860	6.6	14.7	270	270
15%	4.590	6.6	14.7	405	405
20%	4.32	6.6	14.7	540	540

Mix Proportion ID

a. M0- cement+F.A+C.A

b. M5-cement+F.A+C.A+5% Of Marble dust &Fly ash

c. M10-cement+F.A+C.A+10% Of Marble dust &Fly ash(With cement)

d. M10-cement+F.A+C.A+15% Of Marble dust &Fly ash(With cement)

e. M10-cement+F.A+C.A+20% Of Marble dust &Fly ash(With cement)

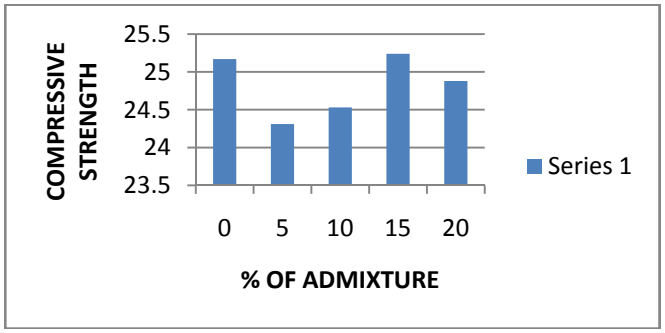

Fig 2 - Compressive strength

IV. EXPERIMENTAL WORK

A. Mechanical properties

Compressive strength

Compressive test was conducted in universal compressive testing machine of capacity 200 kN at a loading rate of 2.5 kN/sec. The compressive strength will achieved for thus combination results are below

TABLE V: Compressive strength

Mix Id	7 days (N/mm^2)	28days (N/mm^2)
M 0	16.67	31.55
M 5	15.77	30.88
M 10	16.22	31.33
M 15	16.88	32.22
M 20	16.44	32

Fig 1 - Compressive strength

Split tensile strength

Split tensile strength test was conducted in universal compressive testing machine of capacity 200 kN at a loading rate of 2.5 kN/sec.

TABLE VI : Split tensile strength

Mix Id	28 days (N/mm^2)
M 0	3.81
M 10	4.13
M 20	3.71

Fig 3 - Split tensile strength

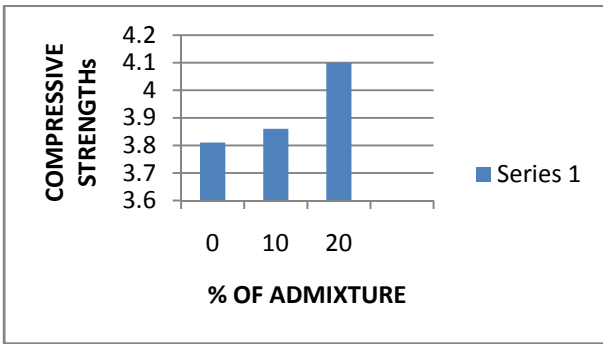

Fig 4 - Split tensile strength

V. RESULT AND DISCUSSION

Compressive strength

The compressive strength had achieved in 15% mix is high. That compressive strength result 16.88 N/mm^2 for 7 days and 28 days strength is 32.22 N/mm^2.The low compressive strength is given M 5 mix proportions.

Split tensile strength

The split tensile strength had achieved in M15 mix is high. That Split tensile strength maximum result 4.13N/mm^2 for 28 days.The low split tensile strength is given M20 mix proportions.

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Mechanical Properties of High Performance Concrete using Steatite powder

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Abstract*—Concrete is probably the most extensively used construction material in the world. The addition of mineral admixture in cement has dramatically increased along with the development of concrete industry, due to the consideration of cost saving, energy saving, environmental protection and conservation of resources. However, environmental concerns both in terms of damage caused by the extraction of raw material and carbon dioxide emission during cement manufacture have brought pressures to reduce cement consumption by the use of supplementary materials. Mineral admixtures such as fly ash, rice husk ash, silica fume etc are more commonly used in the development of HPC mixes. Addition of such materials has indicated the improvements in the strength and durability properties of concrete. In the present investigation, a feasibility study is made to utilize the Steatite powder and Metakaolin as an mineral admixtures in HPC and to investigate the mechanical and durability properties of concrete. The properties of cement, fine aggregate, coarse aggregate and water for M60 grade concrete is arrived. HPC mixes incorporating different percentages of Steatite powder by weight of cement along with 10% of Metakaolin. HPC with mineral admixture of Steatite powder at the replacement levels of 0%, 5%, 10%, 15% & 20% along with industrial by-products of Metakaolin at the replacement level of 10% were studied. The strength characteristics such as compressive strength, tensile strength and flexural strength were investigated to find the optimum replacement of mineral admixture and by-product admixture.*

Keywords—component; formatting; style; styling; insert (key words)

I. INTRODUCTION (*HEADING 1*)

Conventional concrete in India is often produced with four components namely, a) cement and b) Water, together they act as binder. c) The crushed or uncrushed stone and d) natural sand or stone dust. In addition to the above ingredients one or two additional chemicals are also added to the recipe of concrete in order to enhance some properties. Certain materials of mineral origin are also added to concrete to enhance their strength and durability properties of concrete materials such as flyash, silicafume, metakalion which are generally very fine, may be finer than cement, when added to concrete in right proportion can improve the strength and durability of concrete drastically and high strength and high performance concrete is obtained in this manner.

High Performance concrete means concrete which meets special combination of performance and uniformity requirements that cannot be achieved through normal mixing, placing and curing techniques.

HPC is a concrete that has been designed to be more durable and if necessary, stronger than conventional concrete. HPC mixtures are essentially composed of the same materials as conventional concrete mixtures. But the proportions are designed or engineered to provide the strength and durability needed for the structural and environmental requirements of the project.

The demand for Portland cement is increasing significantly in developing countries. Portland cement manufacture is one of the major reasons for CO_2 emissions into atmosphere. It is due to the use of fossil fuels, essential to generate electricity during cement manufacturing process.

The cement industry is one of the two primary product producers of carbon-di-oxide(CO_2), create up to 5% of worldwide man –made emissions of this gas, of which 50% is from the chemical process and 40% from burning fuel. The CO_2 emission from the concrete is directly proportional to the cement content used in the concrete; 900 kg of CO_2 are emitted for the manufacture of every ton of cement. However, environmental concerns concerning rapid utilization of natural resources and CO_2 emission during cement manufacturing process have brought pressure to reduce cement consumption by the use of cement replacement materials (CRMs).

Pozzolanic additives are the materials or admixtures that can improve concrete properties such as concrete strength, durability and impermeability. Pozzolanic additives are used either as partial substitutes of Portland cement or as an addition. The use of pozzolanas for making concrete is considered efficient, as it allows the reduction of the cement utilization while improving the strength and durability properties of the concrete.

The use of supplementary cementitous materials (SCMs) is essential in developing low cost

construction materials for use in developing countries.

Metakaolin differs from other supplementary cementitious materials (SCMs), like fly ash, silica fume in that it is not a by-product of an industrial process; it is manufactured for a specific purpose under carefully controlled conditions. Metakaolin when used as a partial substitute substance for cement, it reacts with $Ca(OH)_2$ one of the by-products of hydration reaction of cement and results in additional C-S-H gel which results in increased strength. Metakaolin is obtained by thermal creation of kaolin clay. This activation will cause a considerable loss of water in its constitution causing a rearrangement of its structure. To find an adequate thermal activation, the temperature range should be established between 650 to 750ºC. Metakaolin is used in oil well cementing to advance the compressive and flexural strength of the hardened cement. Metakaolin also reduces the hardened cement impermeability to liquids and gases. Hence by partially replacing Portland cement with Metakaolin not only reduces CO_2 emissions but also increases the repair life of buildings.

Chemical formula of Metakaolin is $Al_2O_3 \cdot 2SiO_2 \cdot 2H_2O$.

II. Material Details

A. Cement

The most important feature in concrete is Cement. The important criteria for the selection of cement are binding property and it produces microstructure in concrete. OPC of 53 Grade locally available is used in this investigation. The Cement is tested for different properties as per the IS: 4031–1988 and found to be confirming to various specifications of IS: 12269–1987.

Standard Consistency	Specific gravity	Initial setting time in min	Final setting time in min
32.5%	3.13	34	554

TABLE I. PHYSICAL PROPERTIES OF CEMENT

B. Coarse aggregates

The crushed aggregate were collected from the local quarry. The aggregates are locally available. The fractions from 20 mm to 4.75 mm are used as coarse aggregate. Specific gravity of aggregate is 2.75 and Fineness modulus of 6.73. Aggregates are the most mined material in the world.The coarse aggregate used in this experimentation were of 20mm and down size aggregate and tested as per IS: 2386-1963 (I, II and III) specifications. Physical and mechanical properties of coarse aggregates are given in Table II.

Properties	Results	Permissible limit as per IS: 2386-1963
Specific gravity	2.75	In between range 2.6-2.8
Moisture content	0.7%	-
Fineness modulus	6.73	-

TABLE II.PHYSICAL AND MECHANICAL PROPERTIES OF COARSE AGGREGATE

C. fine aggregates

Locally available river sand was used as fine aggregate. The sand used having fineness modulus 3.76 and confirmed to grading zone-II as per IS: 383-1970 specification. Physical properties of fine aggregate are given in Table III.

TABLE III.PHYSICAL PROPERTIES OF FINE AGGREGATE

Property	Results	Permissible limit as per IS: 383-1970
Specific gravity	2.68	Should be between the limit 2.6-2.7
Moisture Content	0.65%	-
Fineness modulus	3.76	-
Grading	Zone-II	-
Bulk density a. Loose b.Compacted	14.67kN/m^3 16.04 kN/m^3	-

D. Water

As per IS: 456-200 Portable water was used for concreting .Water to be used for mixing and curing should be free from harmful materials. In this study, tap water was used for both mixing and curing purposes.

E. Natural Steatite

Natural steatite is also called soapstone or soaprock. It is a talc-schist ($Mg_3Si_4O_{10}(OH)_2$) which is a type of metamorphic rock. It is chiefly composed of the mineral talc and is thus rich in magnesium. Soapstone is moderately soft because of its high talc content, talc having a definitional value of 1 on the Mohs hardness scale. Softer grades may experience soapy when touched. There is no permanent hardness for soapstone because the amount of talc it contains varies broadly.

F. Metakaolin

Metakaolin is a chemical segment that forms upon thermal treatment of kaolinite. Kaolinite's chemical composition is $Al_2O_3{:}2SiO_2$. $2H_2O$ and as a result of thermal treatment in the range of 400-500°C, the water is driven away to form an amorphous aluminosilicate called metakaolin. Metakaolin is white in colour and acts as a pozzolanic material. The reactivity of the metakaolin may also be affected by grinding to a finer particle size. Metakaolin when used as a partial replacement substance for cement in concrete, it reacts with Ca(OH)2 one of the by-products of hydration reaction of cement and results in additional C-S-H gel which results in increased strength.

III. MIX DESIGN

A. Mix Proportion

The aim of mix proportioning is to attain required strength at optimum cost and to enhance the critical, noncritical properties. Mix proportion selection is often best handled by using ACI method combined with EFNARC Guide lines.Mix design is done as per ACI method for M60grade concrete of code ACI 211.4R-93.

Mix	Cement kg/m³	F.A kg/m³	C.A kg/m³	Water litre/ m³
1:1.2:2.62	496.640	606.85	1302.34	151. 475

TABLE V. MIX PROPORTIONS

B. Combinations of Mixes

Mix designation	Mix combinations
CC	C+S+CA
HPC-SM1	C+5%SP+10%MK
HPC-SM2	C+10%SP+10%MK
HPC-SM3	C+15%SP+10%MK
HPC-SM4	C+20%SP+10%MK

TABLE VI. MIX COMBINATIONS

IV. CASTING AND CURING OF SPECIMENS

Concrete testing specimens of required number were casted and cured for 28days, which is correspond to M60 grade of concrete with water binder ratios 0.32 and replacement of cement by Steatite powder for various percentages viz 5,10,15 and 20 along with 10% of Metakaolin. Concrete specimens of size 150 x 150 x 150 mm were casted to find residual compressive strength and size of 100m x 100mm x 100mm were casted to find percentage weight loss after 28 and 56 days of hydrochloric acid immersion.

The specimens were cast in well lubricated moulds. Concrete were placed on the mould and compacted thereafter and left at room temperature for 24hrs before being transferred into the curing tank. After 24 hours, they wereimmersed in water curing tanks until their testing ages.

V. EXPERIMENTAL PROCEDURE

A. *Compressive Strength Test:*

The cube compressive strength results at the 28 days for different replacement levels of Steatite powder along with 10%
Metakaolin of cement. Three specimens were casted for each mix and average value was taken. Specimens were tested on compressive testing machine as per IS 516:1959.

Compressive strength = P/A

Where,

P = Maximum load in N applied to the sample

A = Cross sectional area of the specimen in mm^2

B. *Split Tensile Strength:*

It is an indirect experiment to determine the tensile strength of cylindrical specimens. It was carried out in compression testing machine as per IS 5816:1999.Three specimens were casted for each mix designation and average value was taken.
Split tensile strength test for all mix variations were done for 7 & 28 days and test results obtained are tabulated in Table VIII.

F = 2P/LD

Where, P = Load in N
L = Length of the specimen in mm
D = diameter in mm

C. *Flexural strength:*

It is used to determine of modulus of rupture an unreinforced concrete beam to resist the failure. Flexural strength is depends on the type, size and volume of coarse aggregate used. Three specimens were casted for each mix and average value was taken. Split tensile test was carried out in compression testing machine as per IS 5816:1999.

Flexural strength $F = PL/BD^2$ in N/mm^2

Where,
P = Ultimate load applied to the specimen in N
L = Length of specimen between supports in mm
B = Breadth of the specimen in mm
D = Depth of the specimen in mm

D *Acid Attack:*

The concrete cube specimens of different concrete mixtures of size 100 mm were cast, and after 28 days of water curing, the specimens were removed from the curing tank and allowed to dry for one day. The weights of concrete cube sample were taken. The acid attack test on concrete cube was conducted by immersing the cubes in the acid water for 90 days after 28 days of curing. Hydrochloric acid with pH of about 2 at 5% weight of water was added to water, in which the concrete cubes were stored. The pH was maintained throughout the period of 90 days. After 90 days of immersion, the concrete cubes were taken out of acid water. Then, the specimens were tested for compressive strength. The resistance of concrete to acid attack was found by the Percentage loss of weight of specimen and the Percentage loss of compressive strength on immersing concrete cubes in acid water.

E. ***Sulfate Attack Test:***

The resistance of concrete to sulfate attack was studied by determining the loss of compressive strength or variation in compressive strength of concrete cubes immersed in sulfate water.

Sulphate attack test was carried out by using the concrete cubes of size 150mmX150mmX150mm. The concrete cubes of 150 mm size after 28 days of water curing and dried for 1 day were immersed in 5% MgSO4 and 5% MgSO4 added water for 90 days. The concentration of sulfate water was maintained throughout the period. After 90 days immersion period, the concrete cubes were removed from the sulfate waters and after wiping out the water from the surface of cubes tested for compressive strength following the procedure prescribed in IS: 516-1959. The sulphate attack is obtained from parameters such as loss in mass and loss in strength. This type of accelerated test of finding out the loss of compressive strength is used for determining for assessing sulfate resistance of concrete.

Weight loss (%) = ((W1 - W2)/W1) x 100

V. EXPERIMENTAL RESULTS

TABLE VII. Compressive Strength Test Results

Mix Designation	Compressive Strength in N/mm2	
	7 days	28 days
CC	40.29	61.62
HPC-SM1	42.95	65.03
HPC-SM2	43.55	68.43
HPC-SM3	**46.21**	**72.29**
HPC-SM4	44.22	69.48

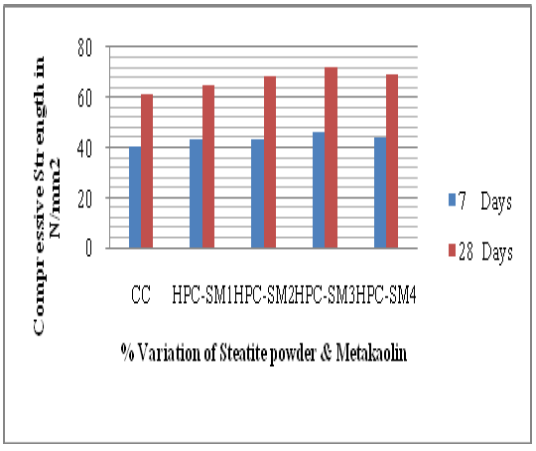

Fig. 1 Comparison of 7, 28 days compressive strength of conventional concrete and Steatite powder admixed concrete

TABLE VIII. Split Tensile Strength Test Results

Mix Designation	Split Tensile Strength in N/mm2	
	7 days	28 days
CC	4.16	5.72
HPC-SM1	4.68	6.43
HPC-SM2	4.90	7.32
HPC-SM3	**5.11**	**7.87**
HPC-SM4	4.73	7.23

Fig. 2 Comparison of 7, 28 days split tensile strength of conventional concrete and Steatite powder admixed concrete

Mix Designation	Flexural Strength in N/mm2
	28 days
CC	5.32
HPC-SM1	5.58
HPC-SM2	5.75
HPC-SM3	**5.90**
HPC-SM4	5.81

TABLE IX. Flexural Strength Test Results

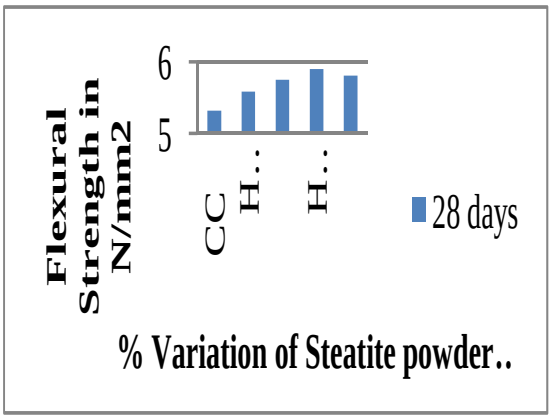

Fig. 3 28 days Flexural strength of conventional concrete and Steatite powder admixed concrete

Mix Designation	Weight before immersion in acid W1 (kg)	Weight after immersion in acid (kg) For 28 days	%loss in Mass for 28 days	%loss in Mass for 56 days
CC	8.416	8.315	1.200	1.307
HPC-SM1	8.652	8.589	0.728	0.797
HPC-SM2	8.407	8.352	0.654	0.713
HPC-SM3	**8.722**	**8.673**	**0.562**	**0.676**
HPC-SM4	8.561	8.486	0.876	0.934

TABLE X. Results of acid resistance test

Mix Designation	Weight before immersion in acid (kg)	Weight after immersion in acid (kg) For 28 days	%loss in Mass for 28 days	%loss in Mass for 56 days
CC	8.56	8.45	1.29	1.40
HPC-SM1	8.57	8.51	0.70	0.93
HPC-SM2	8.26	8.2	0.73	0.85
HPC-SM3	**8.48**	**8.44**	**0.47**	**0.71**
HPC-SM4	8.42	8.35	0.83	0.95

TABLE XI. Results of Sulphate resistance test

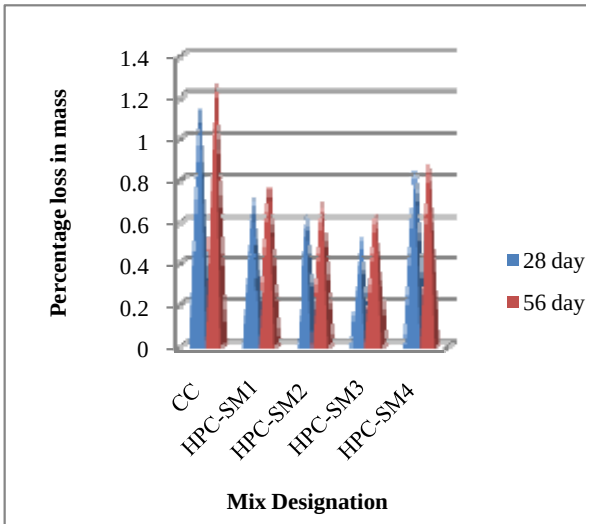

Fig. 4 Weight Loss Due To Sulphate Attack

VI. CONCLUSIONS

1. The compressive strength of concrete for 7&28 days of curing with varying % replacement of Steatite powder and Metakaolin has been increased and have achieved target strength.
2. The split tensile strength of concrete for 7&28 days of curing with varying % replacement of Steatite powder and Metakaolin has been increased and have achieved target strength.
3. The flexural strength of Metakaolin based concrete maintained good result.
4. Concrete mix variations with % replacement of Steatite powder and Metakaolin have showed lower values in case of acid resistance and density of concrete is increased as % replacement of Steatite powder and Metakaolin as increased.

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MECHANICAL BEHAVIOUR OF HIGH PERFORMANCE CONCRETE BY STEEL SLAG

International Conference on Recent Trends in Civil Engineering, Technology and Management (ICRTCETM-2017)

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Abstract

The use of more environment-friendly materials in any industry in general andconstruction industry in particular, is of paramount importance. Environment of this 'only living'planet is wary of pollution due to emissions of a host of greenhouse gases from industrialprocesses. Present day construction industry consumes huge amount of concrete and cement isthe binding material used for making concrete. During production of cement huge amount ofenergy is needed and about 8 % of CO2 is released to atmosphere during cement production. Thismakes concrete a non-eco-friendly material. In consideration of these points, the lime is also used as binding material in this project. A constructionindustry has devised a substitute for concrete, popularly known as 'Steel Slag'.Thestriking feature of this form of concrete is that most of its important ingredients are 100 percentby-products of industries, yet having similar performance record as any other conventionalconcrete material. Compressive strengths of these cubes were determined after 7days 28 days ofcuring period. The compositions of above materials are taken that is 1:1.6:2.56for M20 and 1:1.45:2.25 For M25 and the compressive strength and tensile strength weredetermined adopting conventional testing procedure. To find out the effect of curing period onthe compressive strength, split tensile strength the samples werecured for 7 days and 28 days and tested.

1. Introduction

In this present study a series of experiments have been done to evaluate the characteristic strength of steel slag. The objective of this study is to prevent the exhaustion of natural resources and enhancing the usage of waste materials, concern about global environmental issues, and a change over from the mass-production, mass-consumption, and mass-waste society to a zero-emission society. The physical and chemical properties of the raw materials have been studied to characterize the raw materials. The compressive strength and split tensile strength of these samples were determined after 7 and 28 days.

The Physical properties, chemical properties of materials have been study such as,

1.Gradation of fine aggregate and coarse aggregate

2.Water absorption of Fine aggregate and coarse aggregate.

3.Specific gravity of these above material.

2.MATERIALS USED

Cement:

Portland Slag cement (53 grade) JSW cement conforming to IS: 8112-1989was used. The specific gravity of cement is to found be 2.90.The most important use of cement is to bonding the natural or artificial aggregates to form a strong building material that is durable in the face of normal environmental effects.

Lime:

Lime was procured from the market. It was air dried and mixed thoroughly in dry condition. Then Lime was stored in air tight container for subsequent use. The specific gravity of lime is found to be 2.70 by pycnometer test and it comes under Zone-III (by IS: 12020-19 82).

Classification of Lime by I.S.I:

Indian Standards institute has classified the lime into 3 parts i.e., Class A, B & C. Class A is used for masonry work and can be obtained only in the form of slaked lime. Slaked lime must be the form of powder. Class B is used for mortar whereas class C is used for plaster & white washing. Class C is infecting pure lime. Class B & C can be obtained in the form of slaked or unsliced lime Unsliced lime may contain calcium oxide and little amount of magnesium oxide.

Sand:

The natural river sand confirming zone-III, which was determined by sieve analysis test, was used in this study. The specific gravity of fine aggregate is 2.61 which is found by using pycnometer test.

Blue granite:

Locally available blue granite metals are used. The specific gravity is found to be 2.65which is found by using pycnometer test. The maximum of 20mm size of hard blue granites are used.

Steel slag:

Extraction of 'iron' from ores is a complex process requiring a number of other materials which are added as flux or catalysts. After making steel these ingredients forming a matrix are to be periodically cleaned up. Removed in bulk, it is known as steel –slag. It consists of silicates and oxides. Modern integrated steel plants produce steel through basic oxygen process. Some steel plants use electric arc furnace smelting to their size. In the case of former using oxygen process, lime (CaO) and dolomite (CaO.Mgo) are charged into the converter or furnace as flux. Lowering the launce, injection of higher pressurized oxygen is accomplished. This oxygen combines with the impurities of the charge which are finally separated. The impurities are silicon, manganese, phosphorous, some liquid iron oxides and gases like CO2 and CO. Combined with lime and dolomite, they form

steel slag. At the end of the operation liquid steel is poured into a ladle. The remaining slag in the vessel is transferred to a separate slag pot. For industrial use, different grades of steel are required. With varying grades of steel produced, the resulting slags also assume various characteristics and hence strength properties. Grades of steel are classified from high to medium and low depending on their carbon content. Higher grades of steel have higher carbon contents. Low carbon steel is made by use of greater volume of oxygen so that good amount carbon goes into combination with oxygen in producing CO2 which escapes into atmosphere. This also necessitates use of higher amount of lime and dolomite as flux. These varying quantities of slag known as furnace slag or tap slag, raker slag, synthetic or ladle slag and pit or clean out slag.

Fig1- Steel slag

Utilization of slag

The steel slag is used as coarse aggregates. Natural aggregate resources are becoming more difficult to develop or remove aggregate from the ground when slag can be used as a substitute which reduce waste and conserve resources. It protects and preserves our environment. Benefit from technical advantages offered by many of the steel making slags. High performance products not necessarily low grade applications

3. CONCRETE MIX PROPORTIONS

The procedure for selection of mix proportions used for Portland slag cement concrete is also applicable to concrete incorporating cement, lime or slag with some modifications. The main steps of procedure are as follows,

1. Calculation of cement content i.e. cement + Lime.
2. Calculation of fine aggregate content.
3. Calculation of coarse aggregate content i.e. blue granite + steel slag.

By referring from the code of IS (10262-1982)

For M20 Grade of concrete - 1 : 1.60 : 2.56

Table: 1

S.NO	BLUE GRANITE	STEEL SLAG
1	50%	50%

Table: 2

For M25 Grade of concrete - 1 : 1.40 : 2.25

4. TESTING PROGRAM

COMPRESSIVE STRENGTH:

S.NO	BLUE GRANITE	STEEL SLAG
1	50%	50%
2	25%	75%
3	0%	100%

The compression test is the most important test that can be used to assured the engineering quality in the application of building materials. Prepare the HPC for M20, the mix proportion of cement+lime, sand and blue granite+steel slag was taken as 1:1.60:2.56. The Six different types of specimen were prepared by using these proportion. And the HPC for M25, the mix proportion of cement (75%) +lime (25%), sand and blue granite+steel slag was taken as 1:1.45:2.25. TheHPC concrete cubes were prepared taking cement+lime as binder, sand as fine aggregate and blue granite+steel slagas coarse aggregate and mix was varied as 50, 75 and 100 percent. The nine different types of specimen were prepared by using these proportion. And the standard sizes of cubes of 150 mm *150 mm *150 mm are used.

A specimen of normal concrete with the mix of 1:1.5:3 (cement: sand: aggregate) was prepared to compare with the new HPC. The w/c ratio was taken to be 0.45. To find the effect of curing period on compressive strength, the samples were cured with curing period 7 day and 28 day.The values of all specimens tested 7th, 28th days were recorded and average value was calculated.

SPLIT TENSILE STRENGTH:

The splitting tests are well known indirect tests for determining the tensile strength of concrete sometimes referred as split tensile strength of concrete. This tests were carried out in accordance with IS 516-1999 standards conducted on concrete cylinders of 150 mm diameter and 300 mm length. Each cylinder specimen was placed on its side and loaded in compression along a diameter of the testedcylinder specimens. The load was continuously applied till the specimens failed. The maximum load applied to specimen during the test were recorded and used to calculate split tensile strength of HPC concrete. The split tensile strength of the steel slag concrete was tested for 7 days 28 days.

5.RESULT AND DISCUSSIONS

The compressive strength of concrete from the three different specimens are shown in following table.

SIZE OF SPECIMEN - 150×150×150 mm (cube)

AREA OF SPECIMEN - 22500 mm^2

CEMENT -75%Cement+25% lime

COARSE AGGREGATE - 50% bluegranite+50% steel slag

Table:3 Compressive strength (N/mm^2) test result for M20

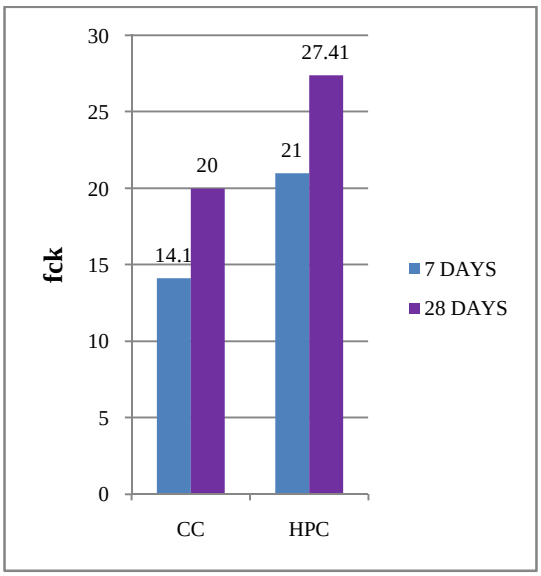


Fig:2

The Split Tensile strength of concrete from the three different specimens are shown in following table.

SIZE OF SPECIMEN -150×300mm (CYLINDER)

Mix	Days	Sample	Split tensile strength (N/mm^2)	Avg. tensile Strength (N/mm^2)
M20	7	1	1.78	1.96
		2	2.00	
		3	2.11	
	28	1	2.55	2.57
		2	2.55	
		3	2.61	

Mix	Days	Sample	Compressive strength (N/mm^2)	Avg. Compressive strength (N/mm^2)
M20	7 days	1	23.11	21.85
		2	21.11	
		3	21.33	
	28 days	1	26.67	27.41
		2	27.78	
		3	27.78	

AREA OF SPECIMEN - 45000mm^2

The compressive strength of concrete from the three different specimens are shown in following table.

SIZE OF SPECIMEN -150×150×150mm (CUBE)

AREA OF SPECIMEN - 22500 mm^2

CEMENT -75% Cement+25% lime

COARSE AGGREGATE -50% blue granite+50% steel slag

Table-4 Split Tensile Strength(N/mm^2)

Test result for M20

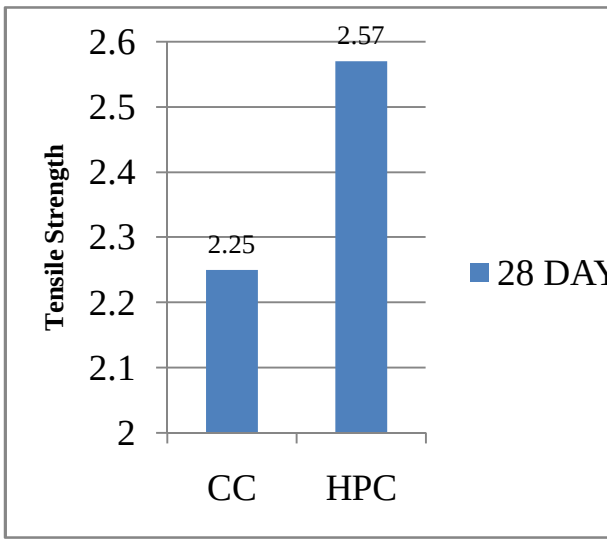


Fig:3

Mix	Days	Sample	Compressive strength (N/mm^2)	Avg. Compressive strength (N/mm^2)
M25	7 days	1	24.89	24.15
		2	23.33	
		3	24.22	
	28 days	1	32.44	32.37
		2	33.56	
		3	31.11	

Table-5 Compressive strength (N/mm^2) test result for M25

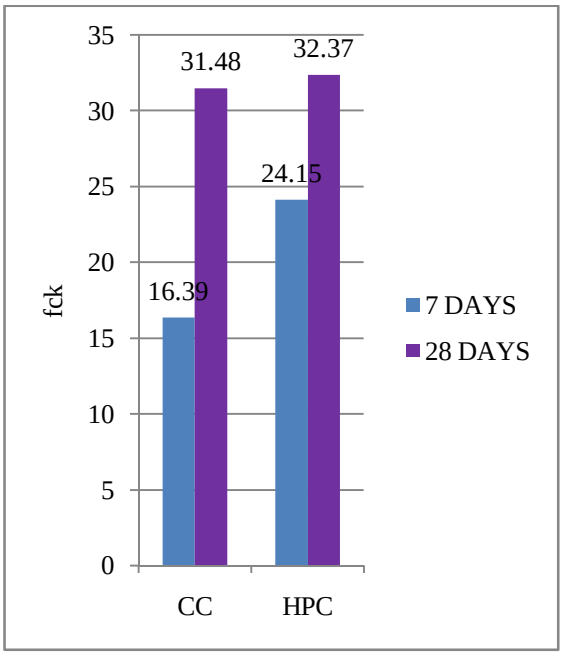


Fig:4

The Split Tensile strength of concrete from the three different specimens are shown in following table.

SIZE OF SPECIMEN - 150×300 mm

(cylinder)

AREA OF SPECIMEN- 45000mm

Table-6 Split Tensile Strength(N/mm^2) test

Mix	Days	Sample	Split tensile strength (N/mm^2)	Avg. tensile Strength (N/mm^2)
M25	7	1	1.78	1.96
		2	2.00	
		3	2.11	
	28	1	2.69	2.62
		2	2.61	
		3	2.55	

result for M25

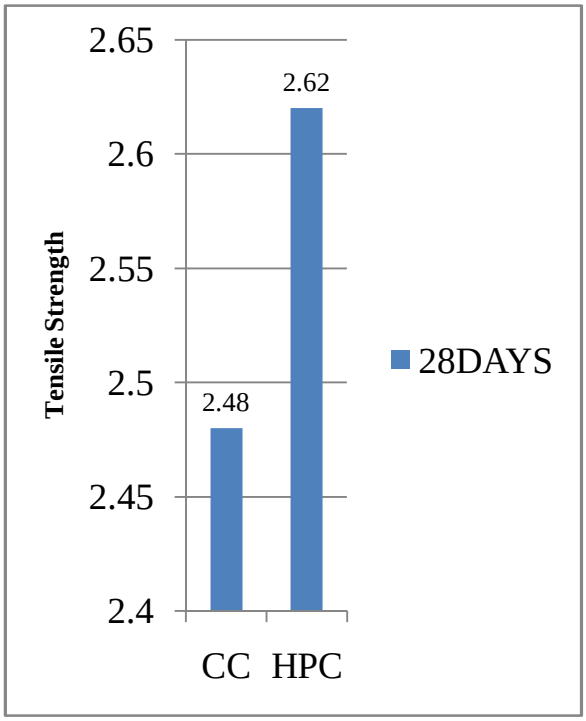


Fig.5

Mix	Days	Sample	Compressive strength (N/mm^2)	Avg. Compressive strength (N/mm^2)
M25	7 days	1	28.89	28.67
		2	27.78	
		3	29.33	
	28 days	1	39.00	37.30
		2	35.56	
		3	37.33	

Table-7 Compressive strength (N/mm^2) test result for M25

The compressive strength of concrete from the three different specimens are shown in following table.

SIZE OF SPECIMEN - 150×150×150 mm (CUBE)

AREA OF SPECIMEN - 22500 mm2

CEMENT - 75% Cement+25% lime

COARSE AGGREGATE - 25% blue granite+75% steel slag

Mix	Days	Sample	Split tensile strength (N/mm^2)	Avg. tensile Strength (N/mm^2)
M25	7	1	1.27	1.39
		2	1.49	
		3	1.41	
	28	1	1.56	1.58
		2	1.41	
		3	1.77	

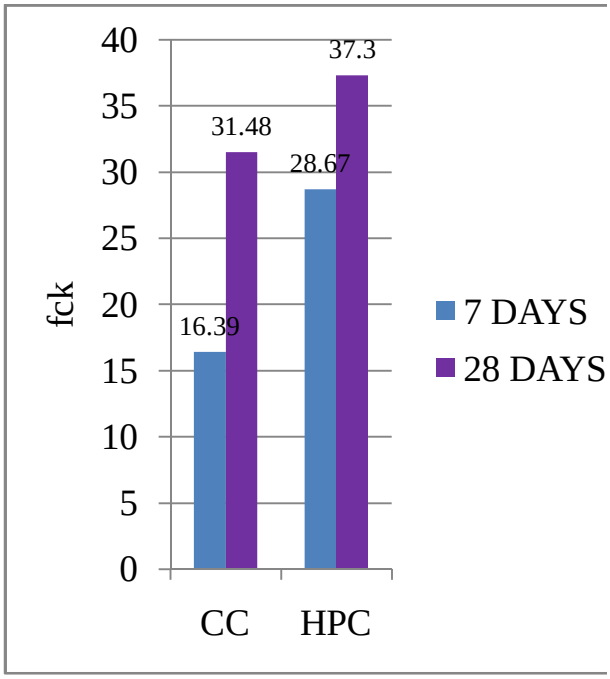


Fig.6

The Split Tensile strength of concrete from the three different specimens are shown in following table.

SIZE OF SPECIMEN - 150×300 mm (CYLINDER)

AREA OF SPECIMEN - 45000mm^2

Table-8 Split Tensile Strength (N/mm^2) test result for M25

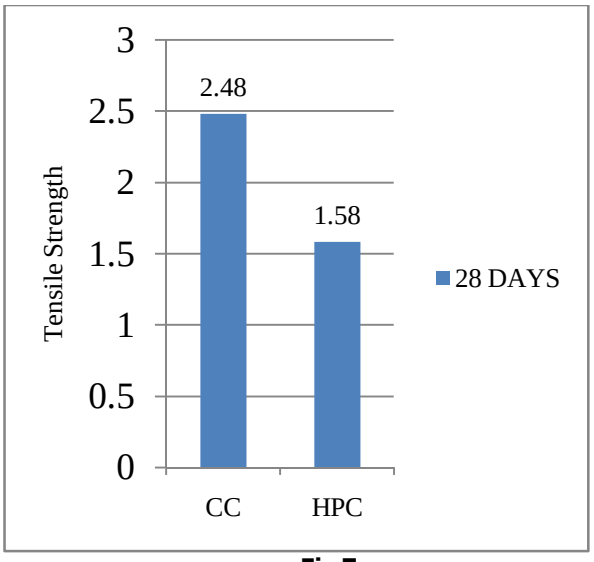


Fig 7

Comparison of test results of each specimen:

Compression strength Test Results: (For M25 grade of concrete at 28 Days)

Table-9 Comparison of Compression test results of each specimen

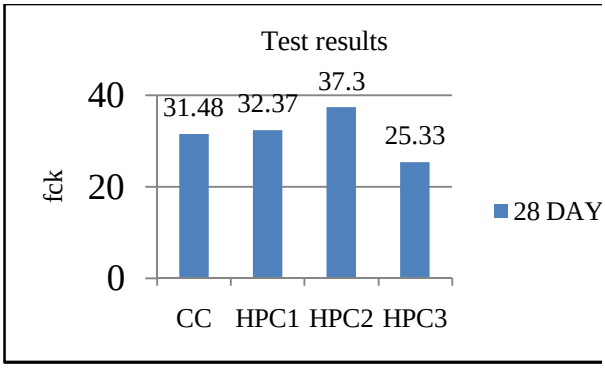


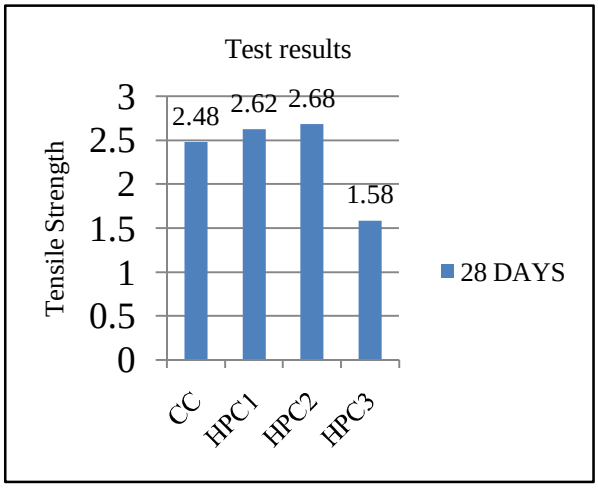
Fig 8

Specimen	% of replacement		Load (KN)	Compressive Strength (N/mm^2)
	lime	Steel slag		
Control concrete	0	0	708	31.48
1	25%	50%	730	32.37
2			755	
3			700	
1	25%	75%	800	37.30
2			840	
3			875	
1	25%	100%	590	25.33
2			575	
3			545	

Split tensile strength Test Results: (For M25 grade of concrete at 28 Days)

Specimen	% of replacement		Load (KN)	Tensile strength (N/mm^2)
	lime	Steel slag		
Control concrete	0	0	175	2.48
1	25%	50%	190	2.62
2			185	
3			180	
1	25%	75%	195	2.68
2			190	
3			185	
1	25%	100%	100	1.58
2			110	
3			125	

Table-10 Comparison of tensile strength results of each specimen



CONCLUSION

From the present studies following conclusions were drawn, The 7 and 28 days compressive strength of concrete of HPC is found to be higher than the normal cement concrete.

For M20 grade of concrete the compressive strength of HPC after 28 days of curing was found to be higher than control concrete. And the Split Tensile strength after 28 days of HPC is also higher than the normal concrete.

For M25 grade of concrete the compressive strength of HPC after 28 days of curing was found to be higher than control concrete.Split Tensile strength after 28 days of HPC is also higher than the normal concrete in 50% and 75% the percentage replacement of coarse aggregate.

The more high compressive strength and Split Tensile strength of HPC achieved at 75 percentage replacement of blue granite by steel slag after 28 days of curing. But the fully replacement of the blue granite by steel slag that result in the reduction in the compressive strength and split tensile strength of high performance concrete compare to the control concrete. In this project work, some attempts have been made to get an alternative material for the preparation of concrete using waste products from steel industry. So we concluded that after sufficient aging, the steel slag can be used as concrete aggregate along mineral admixtures, to produce a higher quality concrete.

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An Experimental Investigation On Soil Stabilization By Waste Materials

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Abstract—*The main objective of this study is to investigate the use of organic waste materials in geotechnical applications and to evaluate the effects of wastes coconut fibre, eggshell powder, rice husk, on shear strength of unsaturated soil by carrying out unconfined compression test on two different soil samples. The results obtained are compared for the two samples and inferences are drawn towards the usability and effectiveness of fiber reinforcement as a replacement for deep foundation or raft foundation, as a cost effective approach.*

Keywords— ***coconut fiber, eggshell powder and rice husk.***

I. INTRODUCTION

Soil Stabilization

Soil stabilization is the process of altering some soil properties by different methods, mechanical or chemical in order to produce an improved soil material which has all the desired engineering properties. Soils are generally stabilized to increase their strength and durability or to prevent erosion and dust formation in soils. The main aim is the creation of a soil material or system that will hold under the design use conditions and for the designed life of the engineering project.The properties of soil vary a great deal at different places or in certain cases even at one place; the success of soil stabilization depends on soil testing. Various methods are employed to stabilize soil and the method should be verified in the lab with the soil material before applying it on the field.

Principles of Soil Stabilization:

• Evaluating the soil properties of the area under consideration.

• Deciding the property of soil which needs to be altered to get the design value and choose the effective and economical method for stabilization.

• Designing the Stabilized soil mix sample and testing it in the lab for intended stability and durability values.

EXPERIMENTAL WORK

The wetting and drying process of a subgrade layer composed of black cotton (BC) and clay soil result into failure of pavements in form of settlement and cracking. Therefore, prior to construction of a road on such subgrade, it is important either to remove the existing soil and replace it with a non-expansive soil or to improve the engineering properties of the existing soil by stabilization. Replacing the existing soil might not be a feasible option, therefore, the best available approach is to stabilize the soil with suitable stabilizers. Various types of soil stabilizers (i.e.,fly ash, cement kiln dust, lime) and locally available materials (i.e., slate dust, rice husk ash) are being used for stabilization of soil. However, the selection of a particular type of stabilizer depends upon the type of subgrade soil and availability of stabilizers.The clay soil which is under experiment is taken near bysingampunari, kalapurin sivagangai district. Egg shell is obtained from restaurants.Rice husk is obtained from natham Rice mill. coconutfibre is obtained from mk coir factory . Due to construction of pavement on these soils, the pavement experiences many problems such as unequal setting due to huge cracks are formed on the surface of the pavement. Black cotton soil also has a huge clay content due to which it will not allow water to drain causing water logging of the pavement. Due to alternate heating and cooling, the cracks widens due to which the needsstabilization.Stabilization can be carried out by adding eggshell, coconut fibre and rice husk during the construction of the pavement.

RICE HUSK :

Rice milling generates a by-product known as husk. This surrounds the paddy grain. During milling of paddy about 78% of weight is received as rice, broken rice and bran. Rest 22% of the weight of paddy is received as husk. This husk is used as fuel in the rice mills to generate steam for the boiling process. This husk containsabout 75% organic volatile matter and

the remaining 25% of the weight of this husk is converted into ash during the firing process, known as Rice Husk Ash (RHA). This RHA in turn contains around 85% - 90% amorphous silica. So for every 1000 kg of paddy milled, about 220 kg (22%) of husk is produced, and when this husk is burnt in the boilers, about 55 kg (25%) of RHA is generated. India is a major rice producing country and the husk generated during milling is mostly used as a fuel in the boilers for processing paddy, producing energy through direct combustion and/ or by gasification. About 20 million tonnes of RHA is produced annually. This RHA is a great environmental threat causing damage to the land and the surrounding area in which it is dumped.Lots of ways are being thought for disposing it by making commercial use of RHA.

EGGSHELL POWDER

Chicken eggshell is a waste material from domestic sources.such as poultries, hatcheries, homes and fast food restaurants.Eggshells were spread on the ground and air dried for 2 days. to facilitate easy milling. After air drying the eggshells weremanually broken and milled into powdery forms which werecollected in polythene bags. The eggshell powder was finallysieved through 425µ sieve. Eggshell powder contains 99.83%of CaO and remaining consists of Al2O3, SiO2, Cl, Cr2O3, MnOand CuO.

COCONUT FIBRE

- Coconut fibre has been categorized as pozzolana, with about 67-70% silica and, approximately 4.9 and 0.95% of aluminum and iron oxides, erespectively
- ***Chemical Composition*:** The quantitative analysis of the percentage composition of silica oxide and other chemical compound such as SO3, K2O, MnO, Fe2O3 and so on, were carried out on the coconut husk

TEST PROCEDURES:

SIEVE ANALYSIS:

In the BS and ASTM standards, the sieve sizes are given in terms of the number of the inch. The complete sieve analysis can be divided into two parts-the coarse analysis and fine analysis. Since black cotton soil is an expansive soil we are using wet sieve analysis to classify the soil. It is advisable to wash the soil portion passing through 4.75mm sieve over 75 micron sieve so that silt and clay particles sticking to the sand particles may be dislodged. Washing should be continued until the water passing through 75 microns sieve is substantially clean. The fraction retained on 75microns sieve is dried in the oven. The dried portion is sieved through various sieves.

Sieving is performed by arranging the various sieves one over the other in the order of their mesh openings. The largest aperture sieve being kept at the top and smallest aperture sieve kept at the bottom. The soil sample is put on the top sieve and the whole assembly is fitted on a sieve shaking machine. The amount of shaking depends upon the shape and the number of particles. At least 10min of shaking is desirable for soils with small particles. The portion of soil sample retained on each sieve is weighed. The percentage of soil retained on each sieve is calculated on the basis of the total mass of soil.

SPECIFIC GRAVITY TEST (G):

Specific gravity test is defined as the ratio of weight of given volume of soil soilds at a given temperature to the weight of an equal volume of distilled water at that temperature both weights being taken in air.

The specific gravity is determined by a 500ml flask, the mass M1 of the empty dry bottle is first taken. The sample is put on the bottle and the mass M2 is taken. The bottle is then filled with water and the entrapped air is removed by applying vacuum. The mass M3 of the bottle soil and water is taken. Finally, the bottle is emptied completely and thoroughly washed, and clean water is filled to top, and the mass M4 is taken.

The specific gravity can be computed as G=(M2-M1) /((M2-M1)-(M3-M4))

ATTERBERG LIMITS:

LIQUID LIMIT(W_L):

The liquid limit is determined with the standard liquid limit apparatus. The apparatus consists of a hard rubber base over which a brass cup drops through a desired height. The brass cup can be raised and lowered to fall on the rubber base with the help of a cam operated by handle. The height of fall of the cup can be adjusted with the help of adjusting screws. Before starting the test the height of fall of the cup is adjusted to 1cm.

About 120 gram of the specimen passing through 425 micron sieve is mixed with water. The portion of the paste is placed in the cup over the spot where cup rests on the base, squeezed down and spread into position and the groove is cut in the soil pat. The handle is rotated at the rate about to revolutions per second, and the numbers of blows are counted until the two parts the soil come into contact. The liquid limit is determined by plotting a graph between number of blows on the abscissa on the logarithmic scale and the corresponding water content as ordinate.

PLASTIC LIMIT(W_P):

Soil specimen passing through 425 micron sieve is taken and mixed with water. The plastic soil mass is left for enough time to allow water to permeate through the soil mass. A ball is formed with about 8gm of plastic soil mass and rolled between the fingers and the glass plate with sufficient pressure to roll the mass into a thread of uniform diameter throughout its length. When a diameter of 3mm is reached, the remould again into a ball. The process of rolling and remoulding is repeated until the thread starts crumbling at a diameter of 3mm.The crumbled threads of kept for water content determination. The plastic limit W_P is then taken as the average of three water content.

Plasticity Index:

The plasticity index is calculated from the relation, $I_P = W_L - W_P$

STANDARD PROCTOR COMPACTION TEST:

About 3 kg of air dried and pulverized soil, passing a 4.75mm sieve, is mixed thoroughly with the small quantity of water. The mixture is covered with wet cloth, and left for the maturing time of about 5 to 30 minutes(or more for clayey soils) to permit proper absorption of water. The quantity of water to be added for the first step depends upon the probable water content for the soil. The initial water content may be taken as 4% for coarse grained soils, and 10% for fine grained soils. The empty mould attached to the base plate is weighed without collar. The collar is then attached to the mould. The mixed and matured soil is placed in the mould and compacted by giving 25 blows of the rammer uniformly distributed over the surface such that the compacted height of the soil is about 1/3 of the layer being given 25 blows. The collar is removed and the excess soil is trimmed off to make it level with the top of the mould. The weight of the mould, base plate and the compacted soil is taken. The bulk density? and the compacted dry density ? For the compacted soil are calculated from the following relation:

D=M/V(g/cc); d=?/(1+w)(g/cc)

Where

M = Mass of the wet compacted specimen (g)

W = Water content (Ratio)

V =Volume of the mould.

The test is repeated with increasing water contents on the soil, and the corresponding dry density? d obtained is then determined .A compaction curve is plotted between the water contents as the abscissa and the corresponding dry densities as the ordinates. The dry density goes on increasing as the water content is increased, till maximum dry density is reached. The water content corresponding to the maximum dry density is called the optimum water content Wo.31

PERMEABILITY TEST

The object of the experiment is to determine coefficient of permeability of the soil using a variable head permeameter.

The following procedure is adopted:

- The permeametermould should be filled with assigned soil sample in a manner specified by the instructor. The weight of the soil filling the mould
- Keep the permetermould assembly in the bottom tank.
- Connect the water inlet nozzle of the mould to the standpipe filled with water .Permit water to flow for some time till steady state of flow is reached.
- Note down the time required for the water level in the standpipe to fall from some convenient initial value(h1) to some final value(h2)
- Repeat the above step at least three steps times and determine the time for the water

Unconfined compression test

This experiment is used to determine the unconfined compressive strength of the soil sample which in turn is used to calculate the unconsolidated, undrained shear strength of unconfined soil. The unconfined compressive strength (qu) is the compressive stress at which the unconfined cylindrical soil sample fails under simple compressive test. The experimental setup constitutes of the compression device and dial gauges for load and deformation. The load was taken for different readings of strain dial gauge starting from ε = 0.005 and increasing by 0.005 at each step. The corrected cross-sectional area was calculated by dividing the area by (1- ε) and then the compressive stress for each step was calculated by dividing the load with the corrected area.

qu= load/corrected area (A')

qu- compressive stress

A'= cross-sectional area/ (1- ε)

RESULTS AND DISCUSSIONS

SIEVE ANALYSIS:

S. NO	IS sieve	Mass retained	% of mass retained	% of cumulative mass retained	% of finer
1	4.75	0.043	4.3	4.3	95.7
2	2.36	0.053	5.3	9.6	90.4
3	1.18	0.079	7.9	17.5	82.5
4	600	0.055	5.5	23	77
5	300	0.05	5	28	72
6	150	0.032	3.2	31.2	69.8
7	75	0.006	0.6	31.8	68.2

Grain size distribution of clay

Result :

% of gravel=4.2%

% of coarse sand=8.0%

% of medium sand=12.4%

% of fine sand=7.20%

% of clay & silt=68.2%

SPECIFIC GRAVITY TEST:

Specific Gravity (G) is defined as the ratio of the weight of the given volume of the soil solids at a given temperature to the weight of an Equal volume of Distilled water at that Temperature, both weights being taken in air. The IS specifies 27 Celsius as the standard temperature for reporting the specific gravity.

Specific gravity is determined by the pycnometer

Materials	Specific Gravity
Clay	2.45
Eggshell powder	1.37
Rice Husk	1.68
Coconut fibre	1.35

Specific gravity results for various Materials

SPECIFIC GRAVITY CALCULATION

Observations and tabulation:

SI.no	DESCRIPTION	WEIGHT IN GRAMS	WEIGHT IN GRAMS
1.	Weight of pycnometer (W1) gm	645	645
2.	Weight of pycnometer + dry soil (W2) gm	865	865
3.	Weight of pycnometer + soil + water (W3) gm	1442	1442
4.	Weight of pycnometer + water (W4) gm	1857	1857
5.	Specific gravity (G)	2.45	2.45

Result

Specific gravity G = 2.45

LIQUID LIMIT CALCULATION

Observation and tabulation:

S.No	Water added in ml	No. of blows
1.	20	45
2.	30	26
3.	40	18

4.	50	10

I_f =45.92 ml
Plasticity index in % = 45.92 - 12
Plasticity index in % = 32.92%
Liquid limit is directly found from the graph (corresponding to 25 number of blows)

Graph for liquid limit of the soil:

X-axis water added in ml, Y- axis number of blows

liquid limit of the soil

Result:

Liquid limit of the soil = 45.92 %
Plasticity index in % = 33.92%

PLASTIC LIMIT CALCULATION

Plastic limit of the soil = 12%
Plastic intex = 45.92 – 12 = 33.92 %

STANDARD PROCTOR COMPACTION TEST

Tabulation:

SI.No	Description	Trial - I	Trial-II	Trial-III
1.	Empty weight of the mould (W1) gm	7295	7295	7295
2.	Weight of mould + soil (W2) gm	9688	9704	9752
3.	Weight of compacted soil (W3=W2-W1) gm	2393	2409	2457
4.	Bulk density (ρ = W3/V)g/cm^3	2.03	1.129	2.08
5.	Water content (w) (%)	5%	12%	14%
6.	Dry density =ρ_d = [ρ / (1+w)] g/cm^3	1.845	1.026	1.890

5.7.FALLING HEAD PERMEABILITY TEST

Tabulation :

SI. No	Description	Unit	Trial-I	Trial -II	Trial – III
1.	Area of stand pipe (dia 2cm)	Cm^2	3.14	3.14	3.14
2.	Cross sectional area of the soil specimen (A) (Diameter = 10cm)	Cm^2	78.54	78.54	78.54
3.	Length of the specimen	L	12.5	12.5	12.5
4.	Initial reading of the stand pipe (h_1)	Cm	80	80	80
5.	Final reading of the stand pipe (h_2)	Cm	70	70	70
6.	Time taken	t sec	2.39	1.81	1.53
7.	Coefficient of permeability K = 2.303al $\log_{10}$ (h_1/h_2) / (A.t)	Cm /s	0.027	0.036	0.044
			0.0362		

Result:

The Coefficient of permeability of the soil = 0.0362cm/sec

UNCONFINED COMPRESSION TEST

Tabulation:

SI.No	Deformation dial reading 1 div = 0.01mm	Deformation Δlμm	Proving ring dial reading (cm)	Axial load(p) kg	Strain ϵ =Δl/l	Area A =A$_0$/(1-ϵ) cm^2	Stress =P/A kg/cm^2
1	20	0.20	0.2	0.6	0.033	16.44	0.020
2	40	0.40	0.4	1.32	0.066	17.02	0.040
3	60	0.60	0.6	1.98	0.100	17.66	0.080
4	80	0.80	0.8	2.64	0.130	16.10	0.110
5	100	1.00	1.0	3.30	0.160	18.92	0.150
6	120	1.20	1.2	3.96	0.200	19.87	0.170
7	140	1.40	1.4	4.62	0.230	20.64	0.200
8	160	1.60	1.6	5.28	0.260	21.48	0.230
9	180	1.80	1.8	5.94	0.300	22.71	0.245
10	200	2.00	2.0	6.6	0.330	23.73	0.260

Strain (ϵ) = Deformation / Height of the specimen

= 0.20 / 7.5

= 0.026

Corrected area = Area of the specimen / (1-ϵ)

= 15.90/ (1-0.026)

=16.32cm^2

Stress = load / corrected area of the specimen

= 0.13 / 16.32

= 0.0079kg/cm^2

Axial load = proving ring x calibrating factor

= (0.2x 10) x (0.026)

p = 0.052kg

Unconfined compressive strength (q_u) = maximum stress from graph

= 0.179kg/cm^2

Shear strength =q_u / 2

= 0.179 / 2

= 0.0895kg/cm^2

Graph:

Draw a graph between stress (X axis) and strain (Y axis)

Result:

Unconfined Compressive Strength (q_u) = 0.179kg/cm^2

Shear strength = 0.089kg/cm^2

EXPERIMENTAL INVESTIGATONS LABORATORY TESTS WITH USING WASTE MATERIALS

LIQUID LIMIT CALCULATION

Observation and tabulation:

(ADDING 5% OF WASTE MATERIALS)

S.No	Water added in ml	No. of blows
1.	20	51
2.	30	33
3.	40	21
4.	50	10

CALCULATIONS:

Flow index (I_f) = (W4 – W1) / log (N_1/N_4)

W4 =50, W1 =20, N_1= 51, N_4= 10

I_f = (50 – 20) / log (51/10)

I_f =42.39 ml

Plasticity index in % = 42.39 – 18.55

Plasticity index in % = 23.84%

Liquid limit is directly found from the graph (corresponding to 25 number of blows)

Graph for liquid limit of the soil:

X-axis water added in ml, Y- axis number of blows

liquid limit of the soil

Result:

Liquid limit of the soil = 42.39 %

Plasticity index in % = 23.84%

Observation and tabulation:

(ADDING 10% OF WASTE MATERIALS)

S.No	Water added in ml	No. of blows
1.	20	55
2.	30	45
3.	40	35
4.	50	22

CALCULATIONS:

Flow index (I_f) = (W4 – W1) / log (N_1/N_4)

W4 =50, W1 =20, N_1= 55, N_4= 22

I_f = (50 – 20) / log (55/22)

I_f =35.58 ml

Plasticity index in % = 35.58 – 27.77

Plasticity index in % = 7.8%

Liquid limit is directly found from the graph (corresponding to 25 number of blows)

Graph for liquid limit of the soil:

X-axis water added in ml, Y- axis number of blows

liquid limit of the soil

Result:

Liquid limit of the soil = 35.58 %

Plasticity index in % = 7.8%

PLASTIC LIMIT CALCULATION

(ADDING 5% WASTE MATERIALS)

Observations :

1. Empty weight of the container (W_0) = 9 gm
2. Weight of the container + wet soil (W1) = 38 gm
3. Weight of the container + dry soil (W2) = 36 gm
4. Weight of water (W1-W2) gm = 2 gm
5. Weight of the wet soil (W1-W_0) gm = 29 gm
6. Weight of the dry soil (W2-W_0) gm= 27gm

Calculations:

Plastic limit =(weight of water / weight of dry soil) x 100

= (2 /27) x100 =18.55%

Result:
Plastic limit of the soil = 18.55%
Plastic intex = 42.39 – 18.55 = 23.84 %

PLASTIC LIMIT CALCULATION
(ADDING 10% WASTE MATERIALS)

Observations :
1. Empty weight of the container (W_0) = 9 gm
2. Weight of the container + wet soil (W1) = 32 gm
3. Weight of the container + dry soil (W2) = 27 gm
4. Weight of water (W1-W2) gm = 5 gm
5. Weight of the wet soil (W1-W_0) gm = 23 gm
6. Weight of the dry soil (W2-W_0) gm= 18gm

Calculations:
Plastic limit =(weight of water / weight of dry soil) x 100
= (5 /18) x100
Plastic limit = 27.77%

Result:
Plastic limit of the soil = 27.77%
Plastic intex = 35.55 – 27.77 = 7.84 %

STANDARD PROCTORS COMPACTION TEST
(ADDIND 4.5% AND 6% WASTE MATERIALS)

Observation:
Diameter of the mould (d) = 10 cm
Height of the mould (h) = 12.73 cm
Weight of the mould(W1) in gms = 5640g
Volume of the mould = 999.812 cm^3

Tabulation:

SI.No	Description	Trial-I	Trial-II
1.	Empty weight of the mould (W1) gm	7295	7295
2.	Weight of mould + soil (W2) gm	9620	9586
3.	Weight of compacted soil (W3=W2-W1) gm	2325	2291
4.	Bulk density (ρ = W3/V)g/cm^3	1.97	1.94
5.	Wastes added	4.5	6
6.	Water content (w) (%)	5%	12%
7.	Dry density =ρ_d = [ρ / (1+w)] g/cm^3	1.758	1.732

Model calculations:

Trial I
Empty weight of the mould (W1) = 7295 gm
Weight of the mould + soil (W2) = 9620 gm
Weight of the compacted soil (W3) = (W2-W1) g = 2325 gm
Bulk density (ρ = W3/V) g/cc
=2325/1178.09
=1.97 g/cc
Water content (w) (%) =12%
Dry density =ρ_d= [ρ /(1+w)] g/cc =1.97 / (1+0.12)
= 1.73 g/cc

Result :
Maximum dry density of the soil = 1.73 g/cc

FALLING HEAD PERMEABILITY TEST
(ADDING 5% AND 10% WASTE MATERIALS)

Observation:
Diameter of the stand pipe (d) = 2cm
Area of the stand pipe (a) = 3.14 cm^2
Diameter of the soil specimen (D) = 10 cm
Area of the soil specimen (A) = 78.54cm^2
Length of the stand pipe (L) = 100cm

Formula Used:
K =2.303al $\log_{10}(h_1/h_2)$ / At
h_1= Initial head
h_2= Final head

Tabulation :

SI. No	Description	Unit	Trial-I	Trial –II	Trial – III
1.	Area of stand pipe (dia 2cm)	Cm^2	3.14	3.14	3.14
2.	Cross sectional area of the soil specimen (A) (Diameter = 10cm)	Cm^2	78.54	78.54	78.54
3.	Length of the specimen	L	12.5	12.5	12.5
4.	Initial reading of the stand pipe (h_1)	Cm	100	100	100

5.	Final reading of the stand pipe (h_2)	Cm	80	60	40
6.	Time taken	t sec	43.5	100	177
7.	Coefficient of permeability K = 2.303al $\log_{10}$ (h_1/h_2) / (A.t)	Cm /s	1.38 X10^{-3}	1.47 9X10^{-3}	1.698 X10^{-3}
			1.519		

Model Calculations:

$K = 2.303al \log_{10} (h_1/h_2) / (A.t)$

$= 2.303 \times 3.14 \times 12.5 \times (\log_{10} (100/80) / (78.54 \times 2.39)$

$K = 1.38X10^{-3}$

Result:

The Coefficient of permeability of the soil = $1.519X10^{-3}$

CONCLUSION

The study has been successfully conducted to assess the geotechnical properties of expansive soils improved with RHA, coconut fiber, egg shell .RHA, CF,EG altered the texture of clay soil by reducing the fine particles. EG, CF and RHA reduce the liquid limits while the plastics limits increased. As a result, the plasticity indices reduced. Swelling potential of expansive soil diminished with the addition of admixtures. The compressibility of soil reduces with blend of lime and RHA. In terms of compaction, the OMC moves to wet side, and MDD enhanced marginally.

- It indicates that the additives, especially Rice husk imbibe much water to attain the MDD.
- The plastic index of each sample reduced with the addition of various percentages of Cf.

- We can utilize the eggshell waste as a useful soil stabilizing material. By using the eggshell powder as a soil stabilizer, we can minimize the waste disposal problem of eggshell.

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Experimental Investigation On Durability And Mechanical Properties Of Self Compacting Concrete Using Mineral Admixtures

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Abstract— Self-Compacting Concrete (SSC) is a flowing concrete mixture that is capable to consolidate under its own weight. The highly fluid nature of SSC makes it suitable for placing in difficult conditions and in section with congested reinforcement. Use of SSC can also assist in minimize hearing related damage on the work site that is induce by vibration of concrete. In this paper experimental studies are carried out to know the fresh and hardened properties of Self Compacting Concrete (SSC) in which cement is replaced by Ground Granulated Blast Furnace Slag (GGBS) and Fly Ash (FA) in different proportions for M30 grade concrete. The proportions in which cement replaced are 20% of GGBS, 25% of GGBS, 20% of fly ash and 25% of fly ash with 1 % of Polypropylene fiber for all combinations. The main aim of this experimental study has been carried out to achieve target compressive strength, flexural strength and split tensile strength. Super plasticizer conplast SP430 used was maintaining workability with constant Water-cement ratio. This is done to determine the efficiency and optimum percentage of replacement at which maximum strength is achieved.

Keywords—Self-Compacting Concrete, Granulated Blast Furnace Slag, Fly Ash, Super plasticizer Conplast SP430.

I. INTRODUCTION

Self-compacting concrete (SCC) is an inventive concrete that does not require vibration for placing and compaction. It is proficient to flow under its own weight, wholly filling formwork and achieving full compaction, even in the incident of congested reinforcement. The hardened concrete is dense, homogeneous and has the same engineering properties and durability as conservative vibrated concrete. The use of SCC will conduct to a more industrialized production, reduce the industrial costs of in situ cast concrete constructions pick up the quality, durability and consistency of concrete structures and remove some of the likely human error. Self-compacted existing (SCC) is one of the high performance concrete which had an massive increase in the construction industry in the recent years. Self-compacting concrete (SCC) first developed in Japan, represent one of the most important advances in concrete technology for decades. Use of Self-compacting concrete offers substantial benefits in enhancing construction efficiency, dropping overall cost, improving working surroundings and in sustainability.

The foremost generation of SCC used in the UK and Europe, such as the one developed in a large European investigate project, which investigated the practicability of with self-compacting concrete in both civil engineering and in building structures, contain a high amount of powder, as well as a high amount of super plasticizer (SP), to make sure adequate filling capacity and transitory abilities and separation resistance. Savings in labor costs might equalize the increased cost related to the use of more cement and SP, but the use of mineral admixtures, such as could raise the flexibility of the concrete, without any increase in the cost.

There is no ordinary method for SCC mix design, and many intellectual institutions as well as admixture, ready-mixed, precast and constricting companies have developed their own mix proportioning methods. As per EFNARC Guidelines for SCC mix design, Filling ability, Passing ability, and Segregation resistance are the primary parameters of concrete which fix the quality and strength of SCC. Slump flow, V-funnel, T5 minutes, L-Box and U-box are the basic tests to check condition of SCC.

ADVANTAGES

There are many advantages of using SCC particularly when the material cost is minimize which include

- ✓ Improved excellence of concrete and decrease of onsite repairs.
- ✓ Faster building times.
- ✓ Lower overall costs.
- ✓ Facilitation of opening of computerization into Concrete construction.
- ✓ Improvement of physical condition and safety is also achieved through exclusion of handling of vibrators.
- ✓ Substantial drop of environmental blast loading on and around a site.
- ✓ Potential for consumption of “dusts”, which are Currently waste goods and which are costly to set out of.
- ✓ Better exterior finishes.
- ✓ Easier insertion

II. MATERIALS

A. ***Cement****: Ordinary Portland cement, 43 Grade conforming to IS: 12269 – 1987.*

TABLE 1: Properties of cement

S,No	Property	Test result
1	Specific gravity	3.16
2	Fineness modulus	3.6%
3	Consistency	32%
4	Initial setting time	30 min
5	Final setting time	10 hrs

B. ***Fine Aggregate****: Locally available river sand confined Grading zone II of IS: 383-1970.*

TABLE 2: Properties of fine aggregate

S,No	Property	Test result
1	Specific gravity	2.8
2	Water absorption	1.5%
2	Fineness modulus	2.8
3	Bulk density	1843.09kg/m^3

C. ***Coarse Aggregate****: Locally available crushed blue granite stones conforming to graded aggregate of nominal size 12.5 mm as per IS: 383 – 1970.*

TABLE 3: Properties of coarse aggregate

S,No	Property	Test result
1	Specific gravity	2.77
2	Impact test	15%
2	Fineness modulus	6.75
3	Bulk density	1673.46 kg/m^3

D. ***Mineral Admixture***

FLY ASH:

Fly ash is a another pozzolanic material it has been shown to be an effective addition for SCC providing increased cohesion and reduced sensitivity to changes in water content. However, high levels of fly ash may produce a paste fraction which is so cohesive that it can be resistant to flow. Two classes of fly ash are defined by ASTM C618: Class F fly ash and Class C fly ash. The chief difference between these classes is the amount of calcium, silica, alumina, and iron content in the ash. The chemical properties of the fly ash are largely influenced by the chemical content of the coal burned.

TABLE 4: Composition of fly ash

S no	Characteristics	Results
1	SiO_2 +Al_2O_3 +Fe_2O_3	95.95
2	SiO_2	59.71
3	MgO	1.06
4	SO_3	---
5	Na_2O	0.63
6	Loss of ignition	0.71
7	Moisture	0.32
8	Calcium oxide as CaO	0.5

GROUND GRANULATED BLAST-FURNACE SLAG (GGBS):

Ground granulated blast furnace slag (GGBS) is a by-product from the blast-furnaces used to make iron. These operate at a temperature of about 1,500 degrees centigrade and are fed with a carefully controlled mixture of iron-ore, coke and limestone. The iron ore is reduced to iron and the remaining materials form a slag that floats on top of the iron. This slag is periodically tapped off as a molten liquid and if it is to be used for the manufacture of GGBS it has to be rapidly quenched in large volumes of water. The quenching, optimizes the cementitious properties and produces granules similar to a coarse sand. This 'granulated' slag is then dried and ground to a fine powder. The physical & chemical properties as shown below table 5&6.

TABLE 5: Physical properties of GGBS

S,No	Property	Test result
1	Specific gravity	2.91
2	Fineness modulus	3.85%
3	Particle size	≥45 microns
4	Surface area	350 to 450 m^2/kg
5	Relative density	2.92 tonnes /m^3

TABLE 6: Chemical properties of GGBS

S.no	Oxide composition	GGBS
1	Cao	37.34%
2	Al2o3	14.42 %
3	Fe2o3	1.11%
4	Sio2	37.73 %
5	MgO	8.71 %
6	MnO	0.02 %
7	Glass	92 %
8	Loss of Ignition	1.41%

E. **SUPER PLASTICIZER:** Conplast sp430 used as a super Plasticizer. Use of this super plasticizer speeds up construction, increases workability and cohesion and aids pumping by reducing line friction and dry packing. Low porosity results in substantially improved water penetration resistance.

Table 7: Properties of Conplast SP430

S.No	Property	Test result
1	Specific gravity	1.220 to 1.225
2	Chloride content	Nil
3	Air entrainment	1% additional air is entrained

III. MIX PROPORTION

For the present work SCC of grade M30 is adopted. The mix design of SCC is obtained as per standard procedure as out lined in IS: 10262-2009 was followed. Details of mix proportions obtained are given in **Table 8** for SCC, cement is replaced by 20% of GGBS, 25% of GGBS, 20% of fly ash and 25% of fly ash with 1 % of Polypropylene fiber for all combinations. These four mix are compared with the Normal SCC (100% cement) Super plasticizer is used to maintain the workability with constant Water/Binder ratio as obtained from the mix design. Typical detailed calculation of mix design as per standard procedure as out lined in IS: 10262-2009.

Table 8: Mix Proportion

Water	Cement	Fine aggregate	Coarse aggregate
177	**503**	**890**	**858**
0.35	**1**	**1.76**	**1.70**

Combinations of mixes

Concrete label	Explanations
SCC	nominal mix
SCC01	Nominal mix + 1% fiber
SCC02	Nominal mix + 1% fiber + 20% GGBS
SCC03	Nominal mix + 1% fiber + 25% GGBS
SCC04	Nominal mix + 1% fiber + 20% Fly Ash
SCC05	Nominal mix + 1% fiber + 25% Fly Ash

IV. EXPERIMENTAL WORKS

Experimental programs are carried out and the results are presented in this paper to study the fresh and hardened properties of SSC concrete.

TEST ON FRESH CONCRETE

The filling ability and stability of self-compacting concrete in the fresh state can be defined by four key characteristics. Each characteristic can be addressed by one or more test methods which are mentioned below. TABLE 10 gives the acceptance criteria.

TABLE 9: Characteristics for fresh concrete

Characteristics	Preferred test methods
Flow ability	Slump-flow Test
Viscosity (assessed by rate of flow)	V-funnel Test
Passing ability	L-box test
Segregation	Segregation resistance (Sieve) Test

TABLE 10: Acceptance criteria

Test	Property	Ranges of values
Slump-flow	Filling ability	2 – 5 sec
V-funnel	Viscosity	6-12 sec
L-box	Passing ability	0.8-1

TABLE 11: Result of fresh concrete

MIX-ID	SCC (CC)	SCC & 1% FIBER	GGBS20	GGBS25	FA20	FA25
Slump flow (650-800)mm	670	685	690	680	705	710
Slump flow(seconds)	4.5	3.9	3.6	4	2.6	2.8
V-funnel	10.8	9.9	9.2	10.1	9.1	8.3
L-box	0.9	0.91	0.90	0.92	0.94	0.96

TEST ON HARDENED CONCRETE

The concrete is tested for the hardened properties like compressive strength, split tensile and flexural strengths each for 7 days, 14 days and 28 days. All tests were performed in accordance with the provision of IS: 516-1959 and IS: 5816-1999. The test results are tested below.

TABLE 12: compressive strength (in MPa) test results

Mix-ID	SCC (CC)	SCC & 1% FIBER	GGBS20	GGBS25	FA20	FA25
7-days	20.99	21.6	24.1	24.74	21.9	23.9
28- days	32.3	33.11	36.44	38.22	33.45	32.8

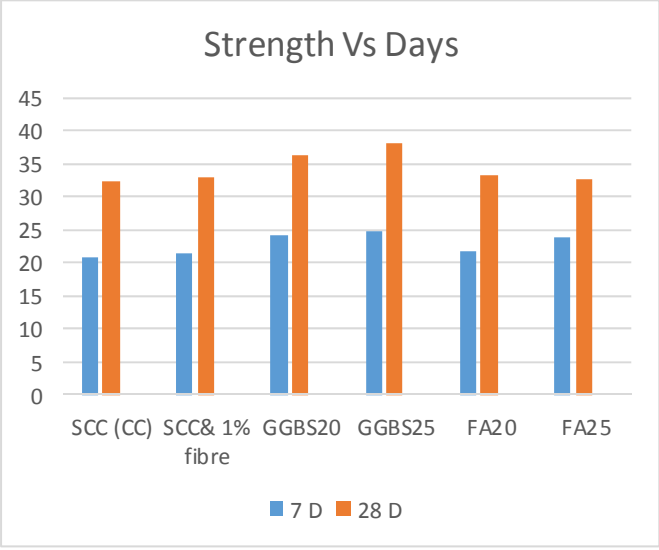

Figure 1: Average Compressive Strength for 7 and 28 Days

Fig 1 Strength Test For Cube

Table 13: split tensile strength (in MPa) test results

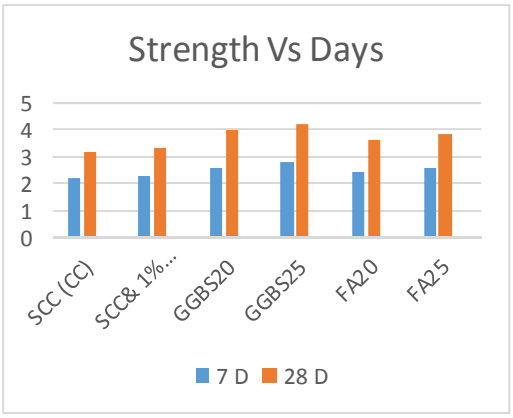

Figure 2: Average Split Strength for 7 and 28 Days

Fig 2 Strength Test For Cylinder

Table 14: Flexural strength (in MPa) test results

Mix-ID	SCC (CC)	SCC & 1% FIBER	GGBS20	GGBS25	FA20	FA25
28-days	5.2	6.2	6.3	6.75	6.27	6.45

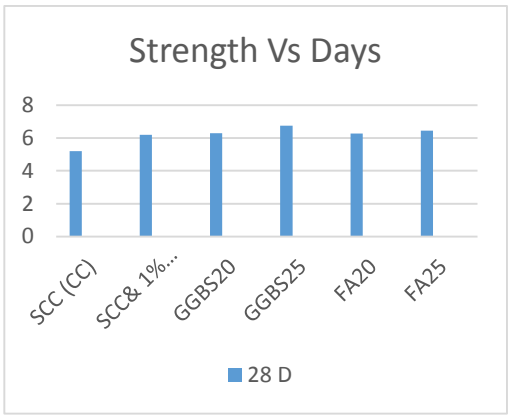

Figure 3: Flexural strength for 28 days

Mix-ID	SCC (CC)	SCC & 1% FIBER	GGBS20	GGBS25	FA20	FA25
7-days	2.19	2.26	2.62	2.84	2.43	2.55
28-days	3.18	3.32	4	4.2	3.6	3.82

TEST ON DURABILITY PROPERTIES

The durability study for SCC after 28 Days and 56 Days curing was done by conducting some of tests such as water absorption, sorpitivity, impact resistant test and sulphate attack and acid attack tests. Table 15, 16,17,18,19 shows the values of different SCC mixes. When cement is replaced by GGBS, a lower percentage super plasticizer is required to maintain the same filling ability.

TABLE 15: Water Absorption Test Results

S.NO	Combination	Dry weight	Wet weight	Percentage of water absorption
1	SCC(CC)	8.954	9.133	2.01
2	SCC&1% fiber	8.816	9.044	2.59
3	GGBS 20	8.649	8.820	1.98
4	GGBS 25	8.677	8.757	0.93
5	FA 20	8.448	8.605	1.87
6	FA 25	8.452	8.540	1.05

Table 16: Impact Resistant Test Results

Type of concrete	First crack	Failure	Impact energy J or N-m	
			First crack	Failure
SCC(CC)	78	80	1586.24	1626.92
SCC &1%FIBER	84	87	1708.66	1769.27
GGBS 20	89	92	1809.94	1870.95
GGBS 25	113	117	2068.45	2088.32
FA 20	94	97	1911.63	1972.64
FA 25	102	110	2022.56	2043.27

TABLE 17: Sorpitivity Test Results

Type of Concrete	Dry weight in grams (W_1)	Wet weight in grams (W_2)	Sorptivity value in 10^{-5} mm/min$^{0.5}$
SCC(CC)	1334.2	1335	2.92
SCC&1%FIBER	1321	1322.5	3.65
GGBS 20	1403.4	1404.1	2.55
GGBS 25	1408.7	1409.2	1.82
FA 20	1410.3	1411.5	1.76
FA 25	1412.6	1413.7	1.63

TABLE 18: Acid attack Test Results

TYPE OF CONCRETE	WEIGHT OF SPECIMEN BEFORE ACID IMMERSION (kg)	WEIGHT OF SPECIMEN AFTER ACID IMMERSION (kg)		%loss in Mass for 28 days	%loss in Mass for 56 days
		28th day	56th day		
SCC(CC)	8.15	7.82	7.71	4.04	5.39
SCC&1% FIBER	8.26	7.86	7.41	4.84	10.29
GGBS 20	8.32	8.01	7.87	3.72	5.40
GGBS 25	8.46	8.16	8.01	3.54	5.31
FA 20	8.29	7.97	7.84	3.86	5.42
FA 25	8.37	8.05	7.92	3.82	5.37

TABLE 18: sulphate attack Test Results

MIX ID	WEIGHT OF SPECIMEN BEFORE SULPHATE IMMERSION (kg)	WEIGHT OF SPECIMEN AFTER SULPHATE IMMERSION (kg)		%loss in Mass for 28 days	%loss in Mass for 56 days
		28th day	56th day		
SCC(CC)	8.26	7.86	7.76	4.84	6.05
SCC&1% FIBER	8.37	7.97	7.87	4.77	5.97
GGBS 20	8.41	8.02	7.91	4.63	5.94
GGBS 25	8.47	8.07	7.97	4.72	5.90
FA 20	8.39	7.99	7.89	4.76	5.95
FA 25	8.42	8.03	7.92	4.63	5.93

VI. CONCLUSION

The following conclusions are drawn for feasibility study conducted on reinforced self compacting concrete with alccofine as partial replacement of cement includes,

The conclusion based on the limited observations from the present investigation on study of compressive, split tensile and flexural strength of the concrete made using alccofine as partial replacement of cement with steel fiber (1%) and constant dosage of super plasticizer (1.5%). The replacement level of alccofine ranging from 10%, 20% and 30% yields higher compressive strength than the conventional concrete mix. Beyond that there is a decrease in the compressive strength of concrete by replacing 40% of alccofine.

- The present investigation has shown that it is possible to achieve self compaction with different percentage of alccofine by the results of slump flow, J - ring, L - box, U – box and V - funnel. The fiber inclusion reduced the fluidity, but presence of alccofine enhance the flow properties.
- Although results obtained from all of the mixes satisfy the lower suggested by EFNARC, all mixes had good flow ability and possessed self-compaction characteristics.
- The addition of steel fiber increases the compressive strength, split tensile strength and flexural strength that is shows the results of SCC01 compared to the nominal concrete mix.
- Compressive strength, split tensile strength and flexural strength variation for the replacement of cement to a level of 30% alccofine indicate as an optimum replacement level. The observed maximum strength in compression, tension and flexural was 48.1MPa, 4.11MPa and 8.12MPa respectively at 28 days.
- The addition of alccofine in SCC improves microstructure of concrete that also helpful to enhance all mechanical properties of concrete.

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Experimental Study On Embankment Slope Protection Using Plastic Wastes, Marble Sludge Powder And Crusher Dust

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Abstract:

Slope can collapse easily by shear if the soil is nearly saturated and high pore pressure can be built up rapidly. Besides, highly decomposed rock in a slope may behave very similar to soil. Slope protection includes increasing the weight bearing capabilities, permeability reduction, performance of in-situ subsoil, sand and other waste material in order to strengthen the embankment. A Plastic material is one of the wide range of synthetic or semi-synthetic organic solids that are mouldable. Plastics are typically organic polymers of high molecular mass, but they often contain other substances. They are usually synthetic, most commonly derived from petrochemicals. Most plastics contain organic polymers. These materials pose environmental pollution in nearby locality because they are non bio-degradable. Marble sludge powder is a solid waste material generated from the marble processing and quarry dust are used as a filler material in this slope protection method to achieve economy and environment saving.

Keywords— Embankment, Shear, Marble sludge powder, Plastic material, quarry dust, environmental pollution.

I.INTRODUCTION:

Properly designed slope protection and stabilization has to include two components: a vegetational - biological and a mechanical-structural component. For maximum effect, both components must be integrally planned prior to road construction. Properly designed and planted vegetative covers play a significant role in preventing surface erosion and shallow mass failures. The function of root systems of live plants on shallow soils on steep slopes is that of a binder for individual soil particles or aggregates. They act in several ways to increase slope stability they bond unstable soil mantles to stable sub soils or substrata, they provide a cover of a laterally strong fine root systems close to the surface, and they provide localized centers of reinforcement in the vicinity of individual trees where embedded stems act like a buttress pile or arch-abutment on a slope. The structural-mechanical component can consist of conventional retaining walls, either the gravity or cantilever type, or a reinforced earth structure. Structural-mechanical stabilization techniques are called for in cases where the potential for deep-seated slope movement or high, lateral earth stresses exists.

Objective

- To protect the embankment slope using plastic wastes, marble sludge powder and crusher dust.
- Usage of waste materials is more economical compared to the concrete
- This can be adopted for water logged area

Scope

- Environmental friendly

- Ecologically appropriate
- Cost effective material
- Appropriate technologies in Slope protection
- Eliminate up to 98% of soil stability problems at the source.

II.MATERIALS AND DESCRIPTION:

1.Marble sludge powder

Fig 1: Marble sludge powder

Marble is a metamorphic rock resulting from the transformation of pure lime stone. Marble sludge powder is an industrial waste containing heavy metals as constitutes. Chemically, marbles are crystalline rocks composed predominantly of calcite, dolomite or serpentine materials. The other mineral constituents vary from origin to origin.

Table 1: Physical properties

Properties	Result
Specific gravity	2.857
Fineness modulus	2.04

Table 2: chemical properties

Characteristics	Result
Loss on ignition,	3.33
SiO_2	69.21
Fe_2O_3	4.40
TiO_2	Nil
Al_2O_3	13.48
CaO	8.40
MgO	0.81
Na_2O	0.26

2. Plastic waste

Today the availability of waste plastic is enormous, as the plastic material have become part and parcel of daily life. They either get mixed with municipal solid waste and/or thrown over land area. If not recycled, their present disposal either by land filling or by incineration. Both the processes have certain impact on the environment. Under this circumstance, an alternate use for the waste plastics is also needed.

Thinner polythene carry bags are most abundantly disposed of waste. Which do not attack the attending rag pickers for collection for onward recycling. For lesser value again this polythene/ polypropylene bags are easily compatible with bitumen at specified condition the waste polymer bitumen blend can be prepared a study of the properties can throw more light on their use for embankment laying.

Fig 2: Plastic waste

Table 3: Properties of plastic waste

	Polystyrene	Polypropylene	Polyethylene
Density g/cm³	1.05	0.90	HD-PE 0.95 LD-PE 0.92
Flammability	Inflammable	inflammable	Inflammable
Ignition temperature	300 - 400°C	300 - 360°C	350 - 360°C
Humidity absorption	<0.1%	<0.1%	<0.1%
Density g/cm³	1.05	0.90	HD-PE 0.95 LD-PE 0.92
Flammability	Inflammable	inflammable	Inflammable

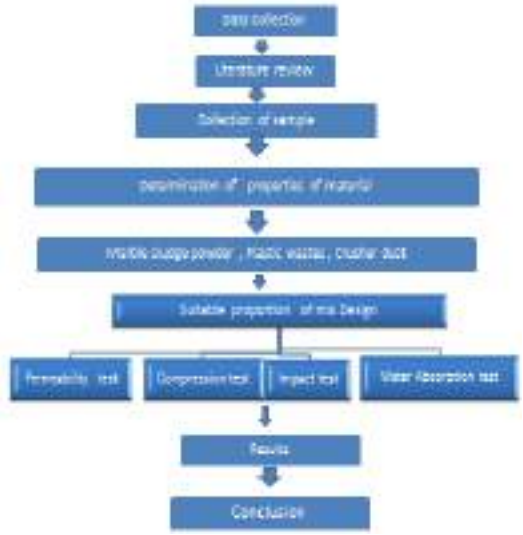
3. Quarry dust

Primary crusher produced 1- 10% fines, secondary crusher produced 5 – 25% fines and tertiary crusher produced 5 – 30% fines. Similarly Limestone contains 20 – 25% fines; sandstone contains 35 – 40% fines and igneous and metamorphic rocks contain 10 – 30% fines.

Table 4: Properties of quarry dust

Properties	Result
Specific gravity	2.765

III.METHODOLOGY:



IV MIX PROPORTION

Table 4: Mix proportion

Marble Sludge Powder %	Crusher Dust %	Plastic Wastes %
50	50	20
		30
		40

Fig 3: Specimens

V.RESULT AND DISCUSSION

1. Water absorption test

Table 5: Water absorption test

S.No	Plastic wastes %	Water absorption %
1	20	0.22
2	30	0.25
3	40	0.39

2. Melting point value

Table 6: Melting point value

S.No	Plastic waste %	Temperature C
1	20	180
2	30	170
3	40	170

3. Density test value

Table 6: Density test value

S.No	Plastic waste %	Density Kg/m^3
1	20	2035.829
2	30	2087.549
3	40	1614.114

4. Compression test value

Table 7: Compression test value

S.No	Plastic waste %	Compression value KN/m^2
1	20	13
2	30	17
3	40	26

5. Impact Test Value

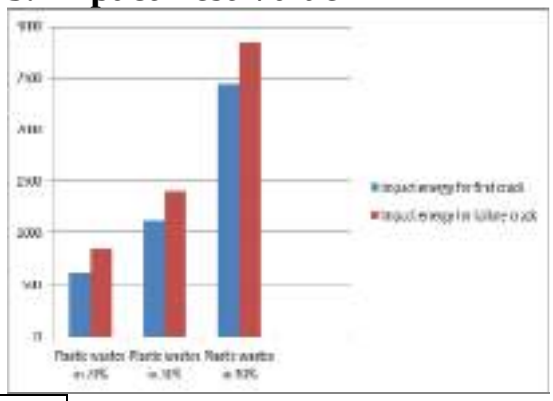


Fig 4: Impact Value

V. CONCLUSION

The following conclusions are made from this experimental study,

1. The compressive strength of the mix with 50% marble sludge, 50% of crusher dust and 40% of plastic waste attains the maximum values of 26 kN/m^2.
2. The absorption of water is lesser for the mix 50% marble sludge, 50% of crusher dust and 20% of plastic waste when compared with other min proportions.
3. The impact test shows better results for the mix 50% marble sludge, 50% of crusher dust and 40% of plastic waste
4. As the waste materials such as plastic, marble sludge and crusher dust is not water absorbent and its has less voids, the permeability of water through them is arrested.
5. Hence based on the results layer coating with these waste materials will protect further failure of a weak soil embankment and also prevents water loss from due to permeability.

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Effect Of Nano Particle On Shear Strength Of Soil

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Abstract:

Soil stabilization means alteration of the soils properties to meet the specified engineering requirements. In order to improve the shear strength and stability by adding Nano particle (marble sludge powder) with binding material as cement. A study is carried out to check the improvements in the properties of vembakottai soil with Marble sludge powder and cement in varying percentages. The test results such as Atterberg's limit, standard proctor compaction, and unconfined compression test obtained on soil mixed at different proportions of marble sludge powder and cement are presented and discussed in this paper

Keywords— Embankment, Shear, Marble sludge powder, Plastic material, quarry dust, environmental pollution.

I.INTRODUCTION:

Soil stabilization a general term for any physical, chemical, biological, or combined method of changing a natural soil to meet an engineering purpose Improvements including increasing the weight bearing capabilities and performance of in-situ subsoil's, sands and other waste material in order to strengthen the embankment.

The prime objective of soil stabilization is to improve the bearing ratio of in-situ soils by 4-6times. The other prime objective of soil stabilization is to improve on-site materials to create a solid and strong sub-base and base courses. In certain regions of the world, typically developing countries and now frequently in developed countries, soil stabilization is being used to construct the entire road.

In past,soil stabilization was done by utilizing the binding properties of clay soils, cement based products such as soil cement, and/or utilizing "rammed earth" technique (compaction) and lime.

The above provided are the up to date information relevant to soil stabilization. Our project totally rely upon stabilizing of soil. In such a way we have decided to use marble sludge powder a nano- particle to strengthen the soil .If the beneficial result have achieved in stabilization by using marble sludge powder then it will be applicable in embankment strengthening of vembakottai dam which have been damaged and caused the water to leak.

Nano Particles

Nanoparticles are particles between 1 and 100 nanometers in size. In nanotechnology, a particle is defined as a small object that behaves as a whole unit with respect to its transport and properties. Particles are further classified according to diameter.

List of nano particles

- Lime
- Silica
- Copper slag
- Cement kiln dust
- Fly ash
- Marble sludge powder
- Quarry rock dust
- Cement

According to cost and availability so we have chosen marble sludge powder.

Objective

- To use the marble sludge powder – Nano particle to strengthen the soil.

- To protect the environment from the pollutant marble sludge powder by effectively using it in the strengthening process.
- To implement this strengthening process in vembakottai dam.

Scope

- Environmental friendly
- Ecologically appropriate
- Cost effective material
- Appropriate technologies in stabilization
- Eliminate up to 98% of soil stability problems at the source.

II.MATERIALS AND DESCRIPTION:

1.Marble sludge powder

Fig 1: Marble sludge powder

Marble is a metamorphic rock resulting from the transformation of pure lime stone. Marble sludge powder is an industrial waste containing heavy metals as constitutes. Chemically, marbles are crystalline rocks composed predominantly of calcite, dolomite or serpentine materials. The other mineral constituents vary from origin to origin.

Table 1: Physical properties

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Al_2O_3	13.48
CaO	8.40
MgO	0.81
Na_2O	0.26

1.1 Partice Size Analyser

The Particle Size Analyzer works on the principle of Dynamic Light Scattering (DLS).In this instrument particle size measurements can be made from 0.3nm to 8µm.1mg of the sample is dispersed in acetic acid taken in a test tube for half an hour. Then the test tube is kept inside the instrument for analysis.

Fig 2: Dynamic Light Scattering

Table 3: Particle size analyser

Peak No.	S.P.Area Ratio	Mean	S. D.	Mode
1	1.00	123.9 nm	11.9 nm	121.3 nm
2	---	--- nm	--- nm	--- nm
3	---	--- nm	--- nm	--- nm
Total	---	123.9 nm	11.9 nm	121.3 nm

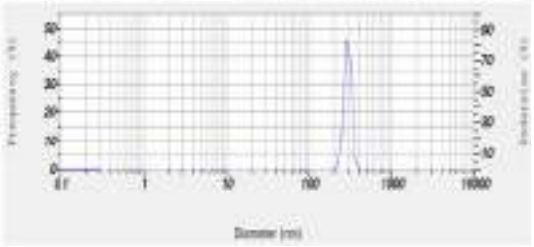

Fig 3: Graph of particle size

III.METHODOLOGY:

Data collection

⇩

Literature review

⇩

Scope of study

⇩

Collection of Sample

⇩

Determination of Index and Engineering Properties of soil sample

⇩

Laboratory investigation on soil with various percentage of marble sludge powder and cement

⇩

Result and Discussion

⇩

Conclusion

V.RESULT AND DISCUSSION

1. Standard proctor compaction test

Fig 4: Proctor Compaction Apparatus

S.N0	Proportion		OMC%	MDD g/cc
	C	MSP		
1	10	10	14	1.133
2		20	12	1.054
3		30	14	0.987

2. Unconfined compressive strength test

Fig 5: Testing Of Unconfined Compressive Strength

S.N0	Proportion		UCS kN/m^2
	C	MSP	
1	10	10	20.11
2		20	20.54
3		30	20.76

3. Direct shear strength

Fig 6: Direct Shear Apparatus

Table : Direct Shear Test Results for 0%

S.No	Normal load (kN)	Shear load (kN)	Deflection dial gauge (mm)	Proving ring reading (mm)	Normal stress (kN/m2)	Shear stress (kN/m2)
1	0.2	0.3	16	81.2	55.55	200
2	0.4	0.6	30	165.3	111.11	400
3	0.6	0.9	39	245.8	166.67	600
4	0.8	1.2	49	327.4	222.22	800
5	1	1.5	58	402.4	277.77	1000
6	1.2	1.8	69	486.6	333.33	1200
7	1.4	2.1	78	541.3	388.88	1400
8	1.6	2.4	89	645.2	444.44	1600
9	1.8	2.7	92	728.5	500	1800
10	2	3	110	804.6	555.55	1767

Table: Direct Shear Test Results for 10%

S.No.	Normal load (kN)	Shear load (kN)	Deflection dial gauge (mm)	Proving ring reading (mm)	Normal stress (kN/m2)	Shear stress kN/m2
1	0.2	0.22	16	81.2	55.55	146.6
2	0.4	0.39	30	165.3	111.11	260
3	0.6	0.76	39	245.8	166.67	506.67
4	0.8	1.24	49	327.4	222.22	826.66
5	1	1.81	58	402.4	277.77	1206.66
6	1.2	1.93	69	486.6	333.33	1286.66
7	1.4	2.45	78	541.3	388.88	1633.33
8	1.6	2.82	89	645.2	444.44	1880
9	1.8	2.94	92	728.5	500	1960
10	2	3.24	110	804.6	555.55	1860

Table : Direct Shear Test Results for 10 – 20%

S.No	Normal load (kN)	Shear load (kN)	Deflection dial gauge(mm)	Proving ring reading (mm)	Normal stress (kN/m^2)	Shear stress (kN/m^2)
1	0.2	0.25	16	81.2	55.55	166.6666667
2	0.4	0.54	30	165.3	111.11	360
13	0.6	0.98	39	245.8	166.67	653.3333333
4	0.8	1.32	49	327.4	222.22	880
5	1	1.67	58	402.4	277.77	1113.333333
6	1.2	1.93	69	486.6	333.33	1286.666667
7	1.4	2.3	78	541.3	388.88	1533.333333
8	1.6	2.52	89	645.2	444.44	1680
9	1.8	2.93	92	728.5	500	1953.333333
10	2	3.1	110	804.6	555.55	1933.666667

Table : Direct Shear Test Results for 10 – 30%

S.No	Normal load (kN)	Shear load (kN)	Deflection dial gauge(mm)	Proving ring reading (mm)	Normal stress (kN/m2)	Shear stress (kN/m2)
1	0.2	0.17	16	81.2	55.55	113.33
2	0.4	0.25	30	165.3	111.11	166.67
3	0.6	0.75	39	245.8	166.67	500
4	0.8	1.34	49	327.4	222.22	893.33
5	1	1.63	58	402.4	277.77	1086.67
6	1.2	1.92	69	486.6	333.33	1280
7	1.4	2.27	78	541.3	388.88	1513.33
8	1.6	2.57	89	645.2	444.44	1713.33
9	1.8	2.68	92	728.5	500	1786.67
10	2	3.24	110	804.6	555.55	1710

V. CONCLUSION

- On the basis of the experimental work , the following conclusions and suggestion are put forward ,
- It is difficult to stabilize soft soil using cement alone. however, appropriate extra admixtures can be used to enhance the soil strength . It has been show that different admixtures play a different role in cement soil stabilization .The main substance which reacts with cement hydration products and the admixtures is the loosely combined soil and marble sludge powder plays a important role in the stabilization of soft soil in foundations .In order to obtain a clear view of the soil ,the influence of different parameters shows good results ,
  1. The liquid limit of the soil is 24%
  2. The UCC strength of 10:20 is 20.65 kN/m^2
  3. The direct shear value is 200 kN/m^2
- Better results can be achieved by using soil –marble sludge powder-cement ratio of 10:20 And we suggest that for soil stabilization marble powder is the best alternative material for soil stabilization.

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A Comparative Study On Various Building Blocks As An Alternative To Conventional Bricks

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Abstract:

The comparison has to be made between Chamber Clay bricks, Fly ash bricks, AAC blocks, CLC blocks and Poro therm blocks based on their engineering properties and economic aspects. The major tests that to be carried out to determine the engineering properties are:

1.*Bulk density*

2. *Direct Compressive strength test*

3. *Water absorption test*

4. *Thermal conductivity test*

The above tests were carried out to check how far the products are conforming to Indian Standards.

Based on the obtained results, Cost Benefit Analysis is made for each building blocks and these values are discussed to know their economic benefits.

KEYWORDS:- Chamber Clay bricks, Fly ash bricks, AAC blocks, CLC blocks,Major Tests,Indian Standarads,Analysis

I.INTRODUCTION

Clay brickwork is made from selected clays moulded or cut into shape and fired in ovens. The firing transforms the clay into a building component with high compressive strength and excellent weathering qualities, attributes that have been exploited for millennia. Clay brickwork is India's most widely used external wall cladding.

Clay bricks are affordable, readily available, mass-produced, thoroughly tested modular building components. Their most desirable acoustic and thermal properties derive from their relatively high mass. They require little or no maintenance and possess high durability and loadbearing capacity.

Concrete bricks are the same size and intended for the same uses as clay bricks. They share many of the same attributes of clay bricks but may require more control joints, may stain more easily and their colour may be subject to fading over time. They are more

porous than clay bricks and must be sealed to prevent water penetration.

The use of clay and concrete brickwork is informed by extensive Indian research, manufacturing and construction experience.

There are various building blocks which are recently emerged in our construction Industry. In practice the better choice of adaptation of suitable wall units is made by comparison on their engineering properties.

The AAC blocks, Chamber clay bricks, Fly ash bricks, Porotherm blocks and CLC blocks are different building blocks which are really competitive in today's construction field

II.TESTING PROGRAM

.1. COMPRESSIVE STRENGTH TEST

The test was conducted based on the procedure described in Indian Codal provisions IS 3495(part 1): 1992

TEST RESULTS

A.Chamber clay Bricks

The Compression strength of Chamber clay bricks = 7.933 N/mm2

B.Fly-Ash Bricks

.

The Compression strength of Fly-Ash bricks = 9.604 N/mm^2

Brick no	Size (cm) L x B	Weight (Kg)	Compression Load (KN)
1	15 x 15	3.442	69.3
2	15 x 15	3.274	63.1
3	15 x 15	3.278	48.5
4	15 x 15	3.290	43.7

C.Porotherm Blocks

Brick no	Size (cm) L x B	Weight (Kg)	Compression Load (KN)
1	15 x 15	1.995	83.2
2	15 x 15	2.047	83
3	15 x 15	1.986	61.2
4	15 x15	2.035	68.8

The Compression strength of Porotherm blocks = 1.4579 N/mm^2

D.AAC Blocks

Brick no	Size (cm) L x B	Weight (Kg)	Compression Load (KN)
1	23 x 10	3.370	175
2	23 x 10	3.467	166.7
3	23 x 10	3.434	205.7

Brick no	Size (cm) L x B	Weight (Kg)	Compression Load (KN)
1	22.9 x 10.6	3.444	251.2
2	22.9 x 10.5	3.445	253.6
3	22.9 x 10.6	3.276	190.5

The Compression strength of AAC blocks = 3.291 N/mm^2

E.CLC Blocks

Brick no	Size (cm) L x B	Weight (Kg)	Compression Load (KN)
1	22.9 x 10.6	3.444	251.2
2	22.9 x 10.5	3.445	253.6
3	22.9 x 10.6	3.276	190.5

The Compression strength of CLC blocks = 2.495 N/mm^2

Block no	Dry oven weight (M1) [kg]	Wet weight (M2) [kg]
1	0.558	0.890
2	0.575	0.909
3	0.555	0.896

2.WATER ABSORPTION TEST

Water absorption

A standard soaking-in-water test can determine the porosity of bricks and blocks, which can then be used as an indication of the potential for the development of problems related to the penetration of salts and other materials into the units, such as salt attack and efflorescence.

Initial rate of absorption

As soon as the bricklayer puts the mortar on a brick, the brick starts to absorb water out of the mortar. The microscopic pores in the brick soak up the water, which carries with it some of the partly-dissolved cement and lime. It's the setting of this cementious material within the brick pores that provides most of the bond between the brick and the mortar, and thus gives the wall its strength.

TEST RESULTS

A.Chamber Clay Brick

Average water absorption = 10.54%

B.Fly-Ash Brick

Average water absorption = 13.52%

Brick no	Dry oven weight (M1) [kg]	Wet weight (M2) [kg]
1	3.150	3.580
2	3.239	3.637
3	2.893	3.316

C.Porotherm Blocks

Average water absorption = 14%

Brick no	Dry oven weight (M1) [kg]	Wet weight (M2) [kg]
1	3.150	3.580
2	3.239	3.637

D.AAC Blocks

Average water absorption = 59.675%

E.CLC Blocks

Brick no	Dry oven weight (M1) [kg]	Wet weight (M2) [kg]
1	3.136	3.462
2	3.140	3.468
3	3.080	3.412

Brick no	Size (cm) L x B x D	Dry Oven Weight(Kg)	Density (Kg/m^3)
1	200 x 100 x 50	0.558	558
2	200 x 100 x 50	0.575	575
3	200 x 100 x 50	0.555	555

Average water absorption = 8.72%

Block no	Dry oven weight (M1) [kg]	Wet weight (M2) [kg]
1	1.020	1.110
2	1.057	1.137
3	1.045	1.125
4	1.017	1.127

3.DENSITY TEST

THREE BLOCKS SHALL BE DRIED TO CONSTANT MASS IN A SUITABLE OVEN HEATED TO APPROXIMATELY 100°C. AFTER COOLING THE BLOCKS TO ROOM TEMPERATURE, THE DIMENSIONS OF EACH BLOCK SHALL BE MEASURED IN CENTIMETRES TO THE NEAREST MILLIMETRE AND THE OVERALL VOLUME COMPUTED IN CUBIC CENTIMETRES. THE BLOCKS SHALL THEN BE WEIGHTED IN KILOGRAMS TO THE NEAREST 10 GM. THE DENSITY OF EACH BLOCK CALCULATED AS FOLLOWS:

Density in kg/m^3 = Mass of block in kg/Mass of block in $cm^2 * 10^6$

TEST RESULTS

A.Chamber clay Bricks

The dry density of chamber clay bricks = 1885.6 Kg/m^3

B.Fly-Ash Bricks

Brick no	Size (cm) L x B x D	Dry Oven Weight(Kg)	Density (Kg/m^3)
1	10.7 x 10 x 5.5	1.108	1882.753
2	11 x 10.5 x 5.8	1.192	1779.370
3	10.8 x 10.5 x 5.8	1.154	1754.546

The dry density Fly-Ash bricks = 1805.56 Kg/m^3

C.Porotherm Blocks

Brick no	Size (cm) L x B x D	Dry Oven Weight(Kg)	Density (Kg/m^3)
1	39.5 x 20 x 15.2	8.899	741.089
2	39.5 x 20 x 15.2	8.906	741.672
3	39.5 x 20 x 15.2	8.912	742.172

The dry density of Porotherm blocks= 741.674 Kg/m^3

D.AAC Blocks

The dry density of AAC blocks = 562.67 Kg/m^3

E.CLC Blocks

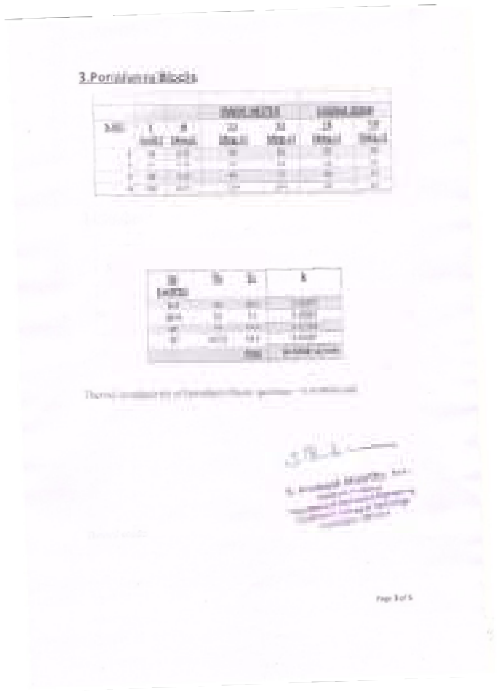
4.THERMAL CONDUCTIVITY TEST

Brick no	Size (cm) L x B x D	Dry Oven Weight(Kg)	Density (Kg/m^3)
1	204 x 103 x 53	1.072	962.612
2	204 x 103 x 54	1.101	970.345
3	203 x 101 x 53	1.077	991.111
4	203 x 102 x 53	1.059	964.992

The dry density of CLC blocks = 972.265 Kg/m^3

Brick no	Size (cm) L x B x D	Dry Oven Weight(Kg)	Density (Kg/m^3)
1	10.2 x 6.1 x 6	0.697	1867.031
2	10 x 6.5 x 6.7	0.795	1825.488
3	10.2 x 5.8 x 5.8	0.674	1964.287

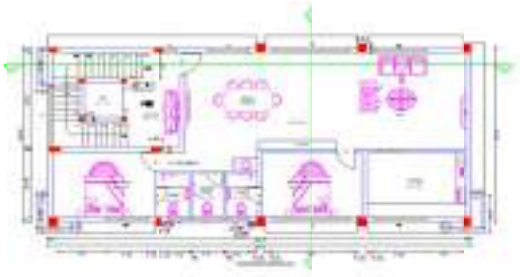
RESULTS:



III. COST BENEFIT ANALYSIS

A. Brick work estimation:

The brick work estimation is made for an apartment building to obtain the costs that are to be spend in the building blocks. The plan and sectional-elevation of the building is shown in the fig.

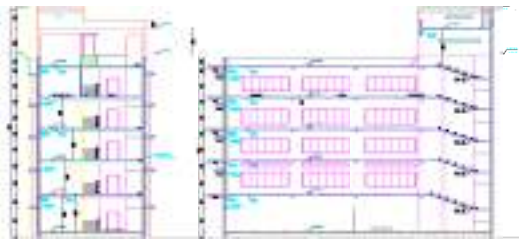


Plan of the Building

Sectional plan of the Apartment building

The walls in the building are divided in to two types:

- M-Type walls (230mm thick walls)
- P-Type walls (115mm thick walls



Brickwork quantity for individual floors is shown in the table:

	Floor height [m]	M-type wall (230mm wall) [m^3]	P-type wall (115mm wall) [m^3]
1st floor	3.81	74.87	8.49
2nd floor	3.505	68.88	7.82
3rd floor	3.505	68.88	7.82
4th floor	3.505	68.88	7.82
	Total	281.5 m^3	31.95 m^3

Total quantity of brick work = 313.45 m^3

B.Cost of blocks in the brickwork of the building

Blocks	Cost(₹)
Clay brick	8, 38,779
Fly-ash brick	6, 82,574
Porotherm brick	11, 96,483
AAC	14, 45,006
CLC	10, 84,804

C.Percentage increase or decrease in Cost difference between Clay bricks and other blocks

BLOCK TYPE	Percentage difference in cost (%)	REMARK
Fly-ash brick	**18.62**	Reduction in cost
Porotherm brick	**42.65**	Increase in cost
AAC	**72.26**	Increase in cost
CLC	**29.33**	Increase in cost

IV. LOAD EFFICIENCY ANALYSIS

A. Assumptions

The Buildings have the following criteria:

a) Building is 5 storeys(G+4) high and has floor area 20 m x 8.5 m.

b) Building is a framed Concrete structure.

c) Building is residential and has the layout as shown:

On comparing the loadings of each building blocks with clay brick loading, Weight reduction percentage in Partition wall are given below:

Blocks	Weight reduction percentage
Fly-Ash brick	*3.2 %*
Porotherm block	*45.6%*
AAC block	*52.7%*
CLC block	*36.4%*

V. CONCRETE QUANTITY TAKE OFF OF THE BUILDING

The frames of the building is modeled and analyzed individually for each blocks using Staad.pro V8i. The

structural members of the frame are optimized for corresponding loadings influenced by the blocks.

NOTE: CONCRETE QUANTITY REPRESENTS VOLUME OF CONCRETE IN BEAMS, COLUMNS AND FOOTINGS DESIGNED ABOVE.

Cost Benefit Analysis for Concreting

Assumptions

- M25 grade concrete
- Mix ratio= 1 : 1 : 2

BLOCK	Concrete quantity take off (m3)
Clay brick	216.97
Fly-ash brick	206.85
Porotherm block	160.72
AAC block	152.14
CLC block	172.1

- Sand 1 unit (100 cu.ft) = ₹ 3250 → 1 cu.ft = ₹ 32.5
- Cement 1 bag (50kg) = ₹ 370
- Course aggregate [20mm-size] 1 unit (100 cu.ft) = ₹ 2800 → 1 cu.ft = ₹ 28

Cost incurred in total Concrete take off for individual bocks

	Concrete quantity take off (m3)	Cost incurred (₹)
Clay brick	**216.97**	11,73,564
Fly-ash brick	**206.85**	11,18,852
Porotherm block	**160.72**	8,69,340
AAC block	**152.14**	8,22,945
CLC block	**172.1**	9,30,997

Percentage reduction in Concrete take off costs of individual blocks with the Clay brick:

	Cost difference (₹)	*Percentage reduction (%)*
Fly-ash brick	54,712	*4.66*
Porotherm block	3,04,224	*25.92*
AAC block	3,50,638	*29.88*
CLC block	2,42,567	*20.67*

VI.THERMAL EFFICIENCY

A. Thermal Conductivity

The Heating Loads induced inside the buildings

	CLAY BRICK	*FLY-ASH BRICK*	*POROTHERM*	*AAC*	*CLC*
Dining hall	5.334	5.296	4.979	4.895	5.058
Bedroom - 1	1.155	1.131	0.975	0.937	1.013
Bedroom - 2	1.233	1.219	1.085	1.050	1.117
Total Heat load *(Ton)*	7.722	7.646	7.039	6.882	7.188

Summary:

- Total Heating Load in the building withclay brick walls = 7.722 ton = 23366.56 kcal/hr.
- Total Heating Load in the building withFly-ash brick walls = 7.646 ton = 23136.59 kcal/hr.
- Total Heating Load in the building withPorotherm block walls= 7.039 ton = 21299.82 kcal/hr.
- Total Heating Load in the building withAAC block walls = 6.882 ton = 20824.74 kcal/hr.
- Total Heating Load in the building withCLC block walls= 7.188 ton = 21750.69 kcal/hr.

Blocks	**Thermal Conductivity k**	
	(W/m.k)	(Btu.in/h.ft^2.°F)
Clay brick	0.72	0.416[1]
Fly-ash	0.66	0.381
Porotherm	0.30	0.175
AAC	0.24[2]	0.1387
CLC	0.37[3]	0.215

VII.CONCLUSION

Based on the above tests and analysis made we came to conclusions as follows:

Even though Clay bricks areused for so many years even more than a millennium in the construction field, it has its own limitations too. This makes an impact to go for the alternative building blocks in the construction industry.

Fly-Ash brick:

On comparing with clay brick, it shows better results in strength and heating load.Cost wise it is best in all cases. But it do not comes under light weight blocks and thermal efficient.Thus, it is the most economic choice among the building blocks we considered. Hence, it is very suitableto for both framed and load bearing buildings.

The other blocks we considered are Porotherm block, AAC block, CLC block:

These blocks comes under Light-weight and Thermal efficient blocks. Hence these blocks do not perform load bearing.

Cost wise AAC blocks shows higher cost of construction than other blocks. The light-density property of AAC blocks can be effectively utilized only for High-rise buildings and not for any typical structures. Hence it is an uneconomical choice for low raise buildings like apartments (< [G + 4]), individual houses and so on. It shows higher thermal efficiency than other blocks. Hence, better comfort can be felt.

CLC blocks is a better economic choice of construction than other light-weight blocks. The cost of construction is nearly same as the construction cost of clay bricks. The load efficiencyof CLC block

is less than Porotherm and AAC blocks.Its thermal efficiency is nearer to Porotherm blocks. Unlike AAC blocks, CLC blocks are not manufactured as factory made products. Hence, Quality of blocks may varies depends on manufacturing units.

The Thermal and Cost efficiency of Porotherm blocksis between AAC and CLC blocks. Based on our test results, it shows low compression strength than the expected values. The construction of wall units using Porotherm requires skilled labor and there may be difficulties in fixing electrical and plumping lines.

VIII.REFERENCE

1. Is 1077-1992 - Common Burnt Clay Building Brick-Specification

2.Is 3495 (Part 1 To 4) - Method Of Tests Of Burnt Clay Building

3. Is 3952 - 1988 - Specification For Burnt Clay Hollow Bricks For Walls And Partition

4. Is.2185 (Part 3) -1984- Specification For Autoclaved Cellular (Aerated) Concrete Blocks

5. Is.6441 (Part 1 To 9) - Methods Of Test For Autoclaved Cellular Concrete Products

6. Is.2185 (Part 4) - 2008 - Preformed Foam Cellular Concrete Blocks (Specification & Test Methods)

7. Is 3346 - 1980 - Method For The Determination Of Thermal Conductivity Of Insulation Materials (Two Slab, Guarded Hot-Plate Method)

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Experimental Study On Removal Of Ammonia From Waste Water By Biologicaltreatment

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Abstract - *Industrialization and Urbanization are the two main aspects for the development of our country that contributes to a higher degree of waste generation in the present scenario. Most of the industries are discharging waste water into the water bodies without any treatment that may contaminate the water bodies. It also affects the life of aquatic organisms, as the raw waste water contains higher amount of nitrogen and phosphorous. Enrichment of these nutrients in waste water leads to Eutrophication. As per disposal standards, the waste water should be treated to bring the values of Nitrogen and Phosphorous within the permissible limits before discharging into the water bodies so that eutrophication in the receiving water body could be controlled.*

Many conventional methods are available to control the algal growth. But there will be more sludge formation after those treatments. The sludge formed will again influence the algal growth. In case of biological treatment, the sludge formed can be treated for biomass production. Hence it is considered to be more effective in removing nutrients from waste water. This project aims at removing ammonia and color from dye waste water and ammonia from domestic waste water using Blue Green Algae. Hence the experimental study was carried out on the respective waste waters. From the test results, it was found that Blue Green Algae is effective in treating waste water without any harm to the environment.

I. INTRODUCTION

Waste water is defined from the standpoint of sources of generation as a combination of the liquid or water-carried wastes removed from institution, commercial and industrial establishments.Water that has beenaffected by anthropogenic influence which is defined as waste water.Municipal waste water is usually conveyed in a combined sewer or sanitary sewer, and treated at a waste water treatment plant. Waste water can originate from many sources such as homes and businesses (domestic waste water) and industries. Storm water, Surface water and Ground water can enter the waste water collection system and add to the volume of waste water. The source of a waste water will determine its characteristics and how it must be treated. Industrial waste water includes toxic chemicals, metals, very strong organic wastes, radioactive wastes, large amount of sediments, high temperature wastes or acidic or caustic wastes. Most modern waste water treatment facilities are designed to treat domestic waste water. Industrial waste waters that contain high strength wastes may have to be pretreated to make them safe to discharge to the collection system. If not, the process at the waste water treatment plant receiving the wastes could be disrupted. Among the various wastes, we have chosen Dye waste water and domestic waster in our project.Beyond many large scale dyeing Industries, there are many small and medium scale dyeing units. The fact is that, the large industries have been provided with proper treatment plants and the state government awarded them with lent free loans considering the betterment of the industries.

But the small and medium dyeing units are not provided with proper treatment plants and they discharge their waste water into the ground water sources as well as into the major rivers and small ponds. This is the very common and threatening problems in many areas particularly in the villages. The waste water which improperly discharges into the ponds acts as the main source of water for the

animals and birds, for the purpose of Irrigation, and also the source of children' recreational activities causes many harmful diseases to all the living organisms. Along with its harmful health treat, it also creates a problem to aquatic life by blocking the sunlight and curtailing the photo-sensitive chemical reactions necessary to the aquatic life.

II. EUTROPHICATION PROCESS

The elements of nitrogen and phosphorus are essential to the growth of Protista and plants and as such are known as nutrients or bio stimulants. Trace quantities of other elements, iron content which is necessary for biological growth, but in most cases nitrogen and phosphorus are the major nutrients of importance.

Nitrogen is an important parameter in the process of protein synthesis, hence the total amount of nitrogen content will be required to evaluate the traceability of waste water by biological processes. Nitrogen content available in maximum amount as compare to permissible limit which indicate waste water as treated. The age of waste water is indicated by the relative amount of ammonia. In aerobic environment, bacteria readily change the form to ammonia.

Growth factors which are sunlight, carbondioxide, and nutrient fertilizers are of higher amount than that of its needed for photosynthesis which causes the excessive plant growth as called Eutrophication, that occurs naturally over centuries as lakes age and are filled in with sediments. However, to accelerate the human activities the rate and extent of eutrophication through both point-source discharges and non-point loadings of limiting nutrients, such as nitrogen and phosphorus, into aquatic ecosystems(cultural eutrophication), with dramatic consequences for drinking water sources, fisheries, and recreational water bodies. For example, aquaculture scientists and pond managers often intentionally eutrophic water bodies by adding fertilizers to enhance primary productivity and increase the density and biomass of recreationally and economically important fishes via bottom-up effects on higher trophic levels. However, during the 1960s and 1970s, scientists linked algal blooms to nutrient enrichment resulting from anthropogenic activities such as agriculture, industry, and sewage disposal. The known consequences of cultural eutrophication include blooms of blue-green algae tainted drinking water supplies, degradation of recreational opportunities, and hypoxia. The estimated cost of damage mediated by eutrophication in the U.S. alone is approximately $2.2 billion annually.

III. SIGNIFICANCE OF AMMONIA

Ammonia occurs as a breakdown product of nitrogenous material in natural
water. It is also found in domestic effluents and certain industrial waste waters. Ammonia causes harmful effect to the fish and other acquatic life. So that the ammonia level is controlled in water which is used as acquarium.Ammonia tests are routinely applied for the monitoring of natural water, sea water; and for pollution control on effluents and waste waters. Ammonia is a naturally occurring compound made up of nitrogen and hydrogen which exists in two basic forms in the environment. It is required by most organisms for protein synthesis, and is a waste product of animal, fish and microbial metabolism. The principal releases of ammonia to the environment from human activity come from a number of industries, municipal waste water effluents and agricultural activities. The major sources of ammonia released to the aquatic environment are municipal waste water treatment plants, which discharge a total of approximate tons/year.
Ammonia is also released in large quantities into the environment by many industries such as pulp and paper mills, mines, food processing and fertilizer production. The majority of these releases go to the atmosphere. Large agricultural releases of ammonia may result from two principal sources: fertilizer application, and intensive animal-rearing facilities. Both activities may result in significant release of ammonia to the air, whereas intensive livestock activities may result in waste water.

The largest quantifiable industrial releases come from ammonia produced in the manufacture of fertilizer, while municipalities are the largest non-industrial source due to their release of sewage effluents. Under some conditions, depending on water pH and temperature, ammonia can become highly toxic to fish and other animals living in the water. These substances are not found to be bioaccumulative, or to transfer up the food chain. Freshwater organisms are most at risk from releases of ammonia in the aquatic environment. Rainbow trout, freshwater scud, walleye, mountain whitefish and fingernail clams are some of the most sensitive species. Some of the observed effects include reduced reproductive capacity and reduced growth of young. Ammonia is considered to be entering the aquatic environment in a quantity or concentration or under conditions that have or may have an immediate or long-term harmful effect on the environment or its biological diversity. The conclusions of the scientific assessment of ammonia are based on an analysis of

risks from releases of ammonia from municipal waste water treatment plants. The assessment report recommends that options to reduce exposure to ammonia from municipal waste water systems should be explored. The assessment suggests that releases of ammonia from several other sources, such as runoff from manure-fertilized fields and intensive livestock operations, may also be causing environmental harm. However, it was not possible to quantify the extent and magnitude of these releases. The report recommends additional research on whether options to reduce exposure to ammonia from such sources should be undertaken.

STANDARDS (IS 2490 – 1985):

CHARACTERISTICS	TOLERANCE LIMIT
pH	5.5-9
BOD	30mg/l
COD	250mg/l
Ammonia	50mg/l

IV. STUDY AREA

Srivilliputhur is a semi-urban town and a municipality in Virudhunagardistrict inthe Indian st ate of Tamil Nadu. As of 2011, the town had a population of 75,396.

Srivilliputtur is one of the old historical town, a 1000-year-old temple, more than 130-year-old Hindu School, 135-year-old Pennington Public Library are remarkable historical evidence for this culturally important town. Thiruppavai, one of the important constituent of devotional Tamil literature period was from this temple town.

The remarkable landmark of Srivilliputhur is 11-tiered tower structure dedicated to the Lord of Srivilliputhur, known as Vatapatrasayee. The tower of this temple rises 192 feet high and is the official symbol of the Government of Tamil Nadu. It is said to have been built by Periyalvar, believed to be the father-in-law of the Temple Deity, with a purse of gold that he won in debates held in the palace of Pandya King Vallabhadeva. Another wonder in Srivilliputtur is Chariot which runs on AdiPuram. Srivilliputhur is well known for its ancient heritage and devotional contributions.

Our sample taken locations are Keelapatti and Nallakutralapuram street at Srivilliputtur .Keelapatti is the place where dyeing is important work of the people.

V. MATERIALS USED

A. Biosorbent

In general, this untreated waste water is mixed with the Municipal waste water and then disposed into nearby ponds. But their standards are relatively higher than the standards of municipal treated waste water. As the water is highly colored and turbid, vegetation along the streams appears scorched despite the fact that water from these streams is the major resource in the area, it is used for cleaning, irrigation of vegetables, drunk by animals and birds and children used for recreation.

A Biosorbentis the natural materials that have the ability to accumulate heavy metals or color from waste water through physico-chemical pathways of uptake. The use of biosorbents is one of the most recent developments in environmental or bio resource technology. The advantage this technique not only include its low-cost, but also its high efficiency, the minimization of chemical or biological sludge. The successful adsorption process also depends on the constant and continuous supply of the materials.

Biomass which allows to passively concentrate and contaminants onto its cellular structures. It is one of as physiochemical process. Engineers and scientist hoping for such a biomass used environmental factors it should be more economical process for removing heavy metals in industrial waste water. Biosorbent used for this experiment as chlorella vulgaris.

B. Chlorella Vulgaris

"Chlorella vulgaris" is eukaryotic, unicellular green algae. "C. vulgaris" is estimated to have been on Earth for more than 2.5 billion years. During that time it has needed to evolve for survival, resulting in many of the useful functions we use today and in the future. Most of the important features deal with its ability to rapidly grow. Common practice normally involves growing populations in photobioreactors. These chambers are consistently shaken and used to control certain aspects of metabolism in "C. vulgaris". Variables such as media, carbonation, and light have been researched heavily to understand the best means of optimal growth. Several uses of "C. vulgaris" have

been researched. First, due to its high mineral and protein levels, it is used in vitamins and has even thought to be a viable food when dehydrated. It has powerful effects in boosting human health. Secondly, many algae produce lipids through photosynthesis. This makes these organisms a viable source for biofuel. "C. vulgaris" is lipid content per biomass is approximately 42%. This is more than soybeans, sugarcane, and corn; making it a viable alternative for biodiesel. With current technology, it can match oil prices of $63.97 per barrel. This is not even mentioning the potential to make money back through waste water treatment. Waste water is treated even in textile production. Research shows that "C. vulgaris" reduced the color dye by 41.8%, Ammonium by 44%, Phosphate by 33%, and Carbon dioxide by 33-62%. "C. vulgaris" ability has also been considered for reducing emissions from power plant. This mostly deals with the ability for rapid growth and the variety of uses. Despite the range of benefits, a negative aspect is the cost to grow "C. vulgaris". Vast areas would need to be used to make much of an impact. CO_2 is a limiting resource for large quantities of C. vulgaris to grow rapidly, in exception to a coal burning power plant. Photobioreactors are often carbonated with brings an extremely high cost in energy to the equation.

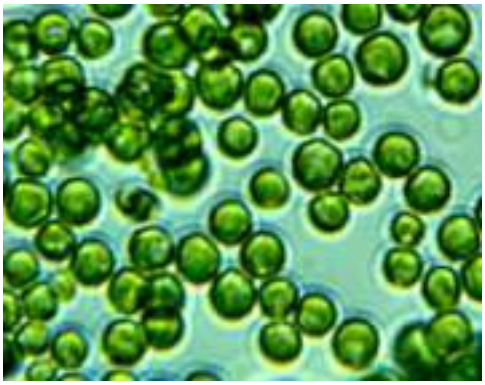


Fig1 :Chlorella Vulgaris

vulgaris is a small, spherical algae that has a size of 5-10µm. It contains 16 chromosones consisting of a range between 0.98 Mb to 4 Mb("Chlorella vulgaris" C-169). This range is rather large due to different geographic location and being a free-living alga. Full sequencing of the chloroplast was found to contain 150,613 bp. The total genome does not have large sections that repeat. This missing inverted repeat is found in most algae. A genomic section found in "Escherichia coli" that are responsible for cell division was found in "C. vulgaris", indicating that chloroplast division in "C. vulgaris" resembles the division taking place in bacteria. Red and brown algae contribute no homologous genomic sections in its chloroplast which means that "C. vulgaris" is surprising more similar to land vegetation. When looking at life history, plants are thought to be evolved from green algae. This correlates with gene segments in "C. vulgaris" that exist in many plants that have been sequenced to date. Currently, no Mitochondrial sequencing has been performed.

VI. TESTING OF SAMPLES

The samples collected are to be tested for the amount of dissolved elements present in it. It is tested for pH, BOD, COD and amount of ammonia.

A. pH TEST

The pH of solution is the negative common logarithm of the hydrogen ion activity.

pH = -log (H)+

In dilute solutions, the hydrogen ion activity is approximately equal to the hydrogen ion concentration.

Exposure to Extreme pH values results in irritation to eyes, skin, and mucous membranes. Eye irritation and exacerbation of skin disorders have been associated with pH values greater than 11. In addition, solutions of pH 10-12.5 have been reported to cause hair fibers to swell. In sensitive individuals, gastrointestinal irritation may also occur. Exposure to low pH values can also result in similar effects. Below pH 4, redness and irritation of the eyes have been reported, the severity of which increases with decreasing pH. Below pH 2.5, damage to the epithelium is irreversible and extensive (10). In addition, because pH can affect the degree of corrosion of metals as swell as disinfection efficiency, it may have an indirect effect on health.

Fig 2: pH Test

When ammonia is available as ammonium ion in waste water, it will be acidic. It will be alkaline, when it occurs in ammonia gas.The results were obtained for Std. solution, treated and untreated water.

pH value of std. solution = 5.99

B. BOD Test

Standard solution
BOD_5 of a given sample can easily be determined in the laboratory by direct pipetting method using the formula method using the following formula.
BOD_5 (mg/l) = (DO_I – DO_f) x volume of bottle
Volume of sample
DO_I, DO_f = DO in diluted samples before and after incubation.
Amount of BOD present in our Standard solution = 8.3mg/lit

C. COD Test

C.O.D is defined as the amount of oxygen, expressed in milligram per litre consumed under specific condition in the oxidation and oxidizable inorganic matter, corrected for the influence of chloride . It indicate the amount of oxygen required to oxidize the carbonaceous matter. C.O.D method is recommended as a supplement to C.O.D test, be the main advantage of C.O.D is that its determination takes 3 hours , compared to more than 5 days for the B.O.D determination, it is used to measure the extent of pollution of domestic and industrial waste.

Principle:

The organic matter of the sample is completely oxidized by reflection with known excess of potassium dichromate solution under acidic conditions. After digestion the remaining unreduced dichromate is back titrated with a standard FAS solution to determine the amount of potassium dichromate consumed and the oxidizable organic matter is calculated in terms of oxygen equivalent.

D. Determination of Ammonia

Ammonia occurs as a breakdown product of nitrogenous material in natural waters. It is also found in domestic effluents and certain industrial waste waters. Ammonia is harmful to fish and other forms of aquatic life and the ammonia level must be carefully controlled in water used for fish farms and aquariums. Ammonia tests are routinely applied for the monitoring of natural water, sea water; and for pollution control on effluents and waste waters.

VII. RESULTS AND DISCUSSION

Dye Waste Water V_s Domestic Waste Water

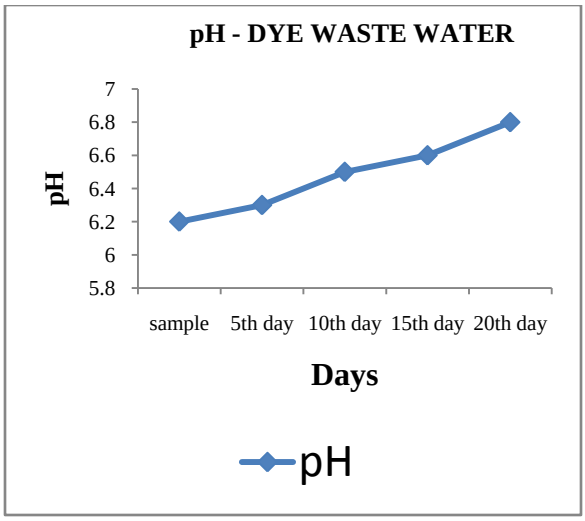
Table :1 pH, BOD,COD, Ammonia –Dyewaste Water

DESCRIPTION	PH	BOD (mg/lit)	COD (mg/lit)	AMMONIA (mg/lit)
Sample	6.2	13.7	268	84.3
5th day	6.3	10.9	242.27	71.6

DESCRIPTION	pH	BOD (mg/l)	COD (mg/l)	AMMONIA (mg/l)
Sample	7.9	108.3	230	4.6
3rd day	8.1	86.4	200.4	2.9
5th day	8.1	79.8	189.7	0.89

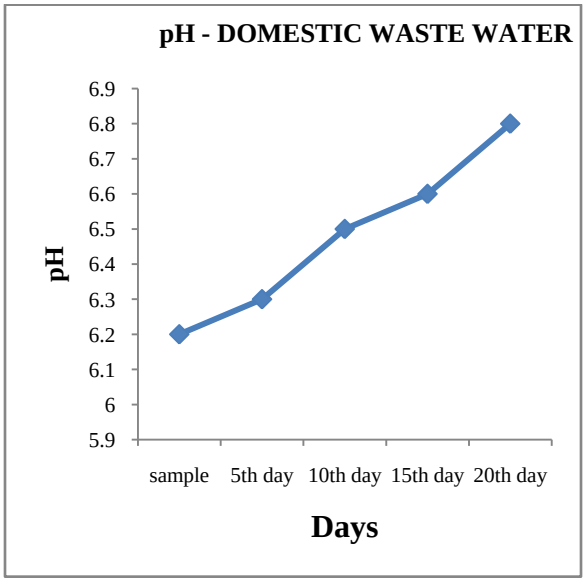
10th day	6.5	9.2	227.8	57.3
15th day	6.6	8.5	214.4	52.2
20th day	6.8	8	198	43

Table : 2 pH, BOD,COD, Ammonia – Domestic Waste Water



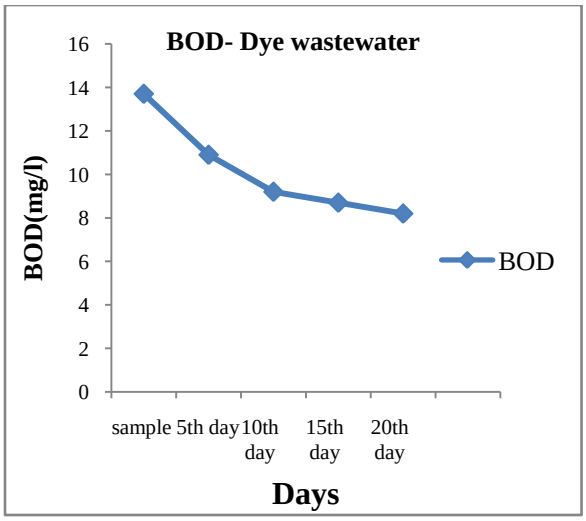
GRAPH 1

The values of pH was increased due to the treatment with algae. It was found that pH value was increased by 10% and the waste water approaches to neutral solution



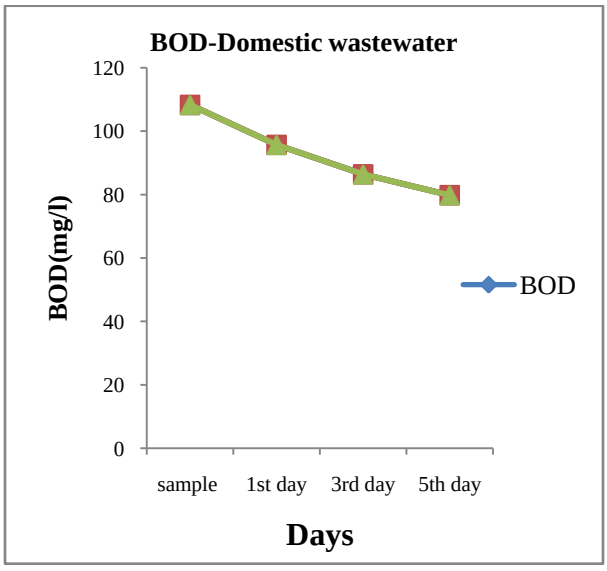
GRAPH 2

The values of pH was increased due to the treatment with algae. It was found that pH value was increased by 10% and the waste water approaches to neutral solution



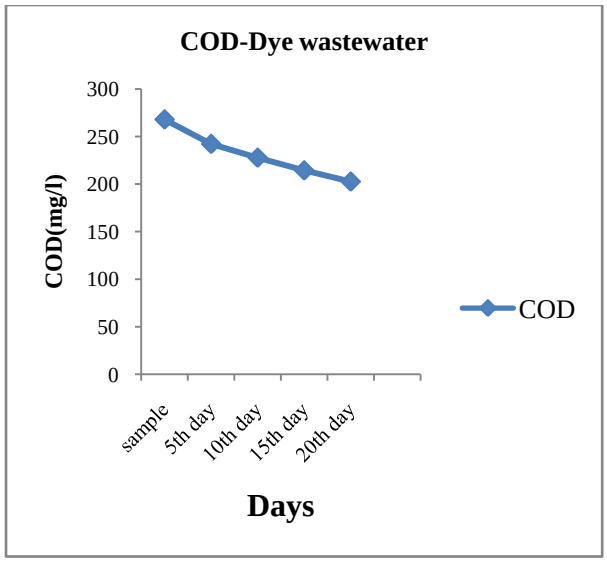
GRAPH 3

The BOD Values were decreased due to treatment with algae.It was found that the value was decreased by 41.6%



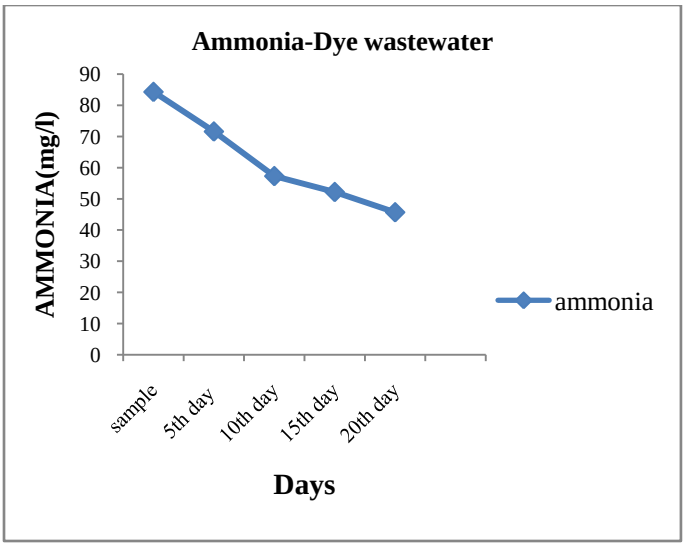
GRAPH 4

The BOD Values were decreased due to treatment with algae.It was found that the value was decreased by 26.3%.



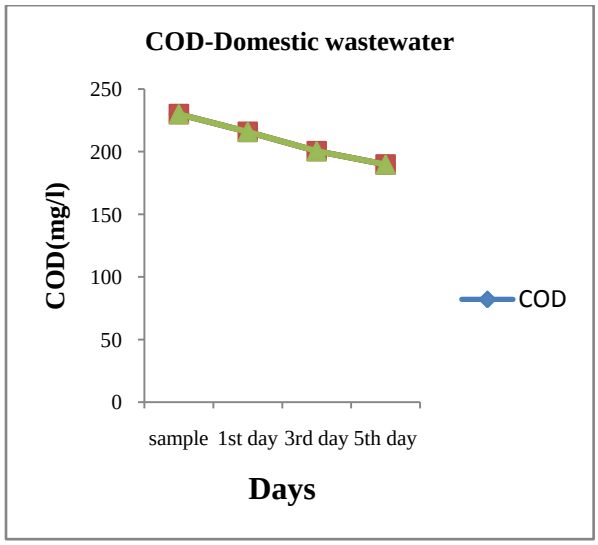
GRAPH 5

The COD Values were decreased due to treatment with algae.It was found that the value was decreased by 26.11%



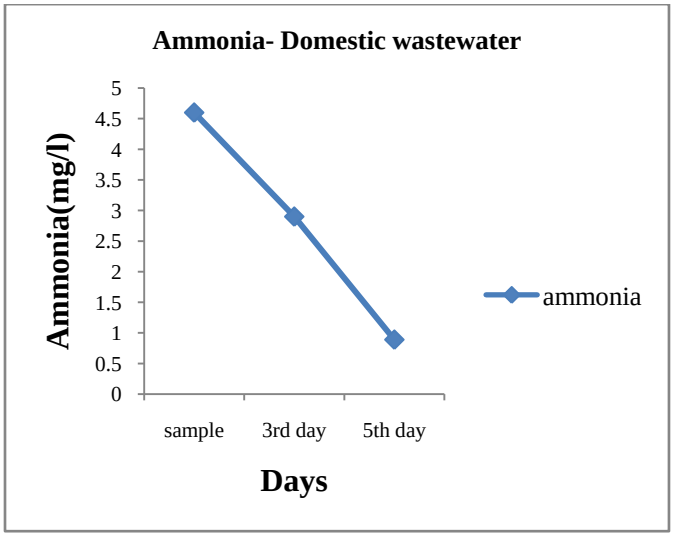
GRAPH 7

The Ammonia Values were decreased due to treatment with algae.It was found that the value was decreased by 5%



GRAPH 6

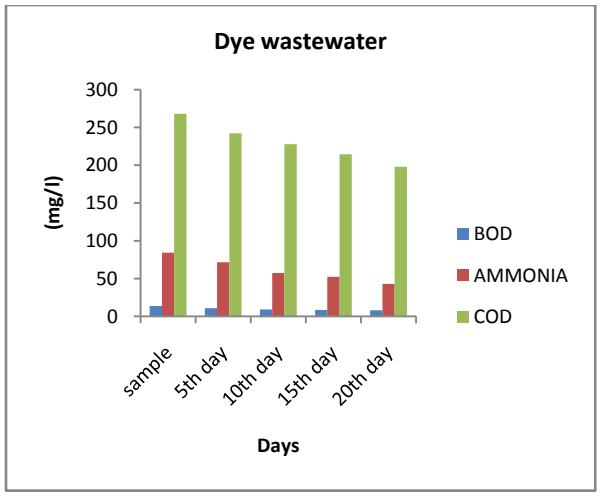
The COD Values were decreased due to treatment with algae.It was found that the value was decreased by 17.5



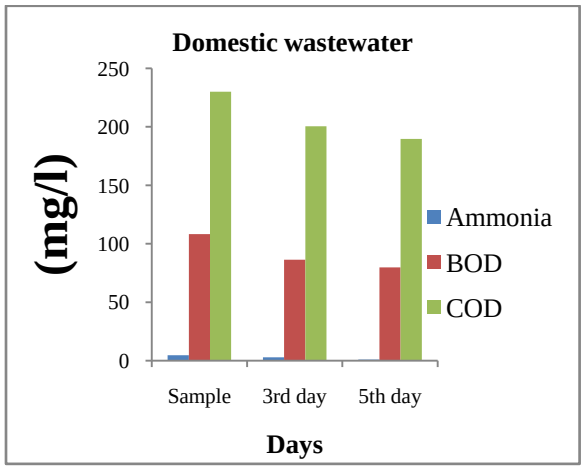
GRAPH 8

The Ammonia Values were decreased due to treatment with algae.It was found that the value was decreased by 80%.

VIII. COMPARISION CHART FOR TEST RESULT



GRAPH 9



GRAPH 10

CONCLUSION

Experimental study was carried out using algae Chlorella vulgaris to find pH, BOD, COD, ammonia level in domestic waste water and dye waste water. From the test results we have found that the pH level was increased when treated with Chlorella vulgaris. BOD, COD levels were also reduced. Ammonia level has reduced by 96% after treatment. This level was attained after 20 days of treatment of waste water with Chlorella vulgaris. Readings were taken after every 5 days to find variation in ammonia level. We found that the values of pH, BOD,COD, ammonia are within the permissible tolerance limit. IS code 2490 – 1985,IS code 4674 – 1973 are referred to find the tolerance limit of dye waste water and domestic waste water respectively.

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Strength and Durability Study of Bricks Using Marble Sludge Powder and Bottom Ash

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Abstract**—***Brick is one of the most common masonry units as a building material due to its properties. The rapid growth in today's construction industry has obliged the civil engineers in searching for more efficient and durable alternatives far beyond the limitations of the conventional brick production. Many attempts have been made to incorporate wastes into the production of bricks and recycling such wastes by incorporating them into building materials is a practical solution for pollution problem. So the proposed system is to the invention of waste marble sludge powder and bottom ash as the replacement of clay bricks regarding the strength and durability studies. In our project, totally 200 number of bricks are to be casted with partial replacement of marble sludge powder and the bottom ash. The percentage of replacement is carried out in this work as 0%, 15% and 30% by total volume. The strength and durability test of bricks is to be calculated. The world wide annual production of bricks is currently about 1391 billion units and demand of bricks is predicted to be continuously increasing. It is also for reduction in the use of natural resources, disposal of waste, prevention environmental pollution and also save energy.*

Keywords— Marble Sludge Powder. Bottom Ash, Sand and Brick.

I. INTRODUCTION

Brick is one of the oldest manufactured building materials in the world. As early as 14,000 BC, hand-moulded and sun-dried clay bricks were found in the lower layers of Nile deposits in the Egypt. Clay was also ancient Mesopotamia's most important raw material and most buildings during that time were made of clay bricks. The earliest use of bricks recorded was the ancient city of Ur (modern Iraq) that was built with mud bricks around 4,000 BC and the early walls of Jericho around 8,000 BC. Starting from 5,000 BC, the knowledge of preserving clay bricks by firing has been documented.

The development of different types of bricks continued in most countries in the world and bricks were part of the cargo of the First Fleet to Australia, along with brick moulds and a skilled brick maker. Bricks have continuously been used by most cultures throughout the ages for buildings due to their outstanding physical and engineering properties

The main raw material for bricks is clay besides clayey soils, soft slate and shale, which are usually obtained from open pits with the attendance of disruption of drainage, vegetation and wildlife habitat.

Clays used for brick making vary broadly in their composition and are dependent on the locality from which the soil originates. Different proportions of clays are composed mainly of silica, alumina, lime, iron, manganese, sulphur and phosphates.

II. MATERIALS USED

A. *Fine Aggregate*

Those fractions from 4.75 mm to 150 micron are termed as fine aggregate. The river sand is used as fine aggregate conforming to the requirements of IS: 383-1970. Sieve analysis was done using standard sieve analysis procedure and the sand conforms to Zone II

B. *Water*

Water is the most important constituent of a concrete mass which enables bonding between cementitious materials and the aggregates. A part of mixing water is utilized in the hydration of cement to form binding matrix in which the inert aggregates are held in suspension until the matrix has harden. The remaining water serves as a lubricant between the fine and coarse aggregate and makes concrete workable. Water Hardness maximum 100 PPM Need Industrial softer for hard water

C. *Bottom Ash*

Bottom ash is part of the non-combustible residue of combustion in a furnace or incinerator. In an industrial context, it usually refers to coal combustion and comprises traces of combustibles embedded in forming clinkers and sticking to hot side walls of a coal-burning furnace during its operation.

At a time when the riverbed sand is getting scarce and its price fast rising, the Neyveli Lignite Corporation has evolved a technology to use bottom ash, a residue being collected from the thermal power stations, as substitute for sand.

TABLE 1 Physical Properties of Bottom Ash

PROPERTY	BOTTOM ASH
Specific gravity	2.2
Bulk density	745 kg/cum
Plasticity	None
Absorption	1.2%

D. Marble sludge powder

Marble is a metamorphic rock resulting from the transformation of pure lime stone. Marble sludge powder is an industrial waste containing heavy metals as constitutes. Chemically, marbles are crystalline rocks composed predominantly of calcite, dolomite or serpentine materials.

Marble stone industry generates both solid waste and stone slurry. Whereas solid waste results from the rejects at the mine sites or at the processing units, stone slurry is a semi liquid substance consisting of particles originating from the sawing and the polishing processes and water used to cool and lubricate the sawing and polishing machines.

III. MIX PROPORTION AND MIX DESIGN

In order to know the best proportion of Marble sludge powder and Bottom ash, we make 200 different test bricks of dimension 19 x 9 x 9cm. The different eight proportions are as following

TABLE 2 Proportions of Materials

SAMPLE	**MARBLE SLUDGE (% in vol.)**
CS	0
S1	15
S2	30
S3	0
S4	15
S5	30
S6	0
S7	15
S8	30

TABLE 3 Mix Design

Sample	Marble sludge powder (Kg)	Bottom ash (Kg)	Water in % in weight
CS	-	-	10
S1	0.311	-	10
S2	0.623	10	10
S3	-	0.173	10
S4	0.311	0.173	10
S5	0.623	0.173	10
S6	-	0.346	10
S7	0.311	0.346	10
S8	0.623	0.346	10

IV. MAKING OF BRICKS

In recent years the brick industry has been facing an acute shortage of skilled molders, kiln setters, firemen,etc ,which resulted in a fall in production and deterioration in quality of bricks. Therefore the necessity of adopting so me mechanized. Means of shaping the bricks so as to make the process independent of individual skill was realized. Simple brick making plants in which only the shaping process is mechanized can be based on soft-mud, extrusion or semi dry process. At present only the extrusion machines are produced indigenously and some expertise in the manufacture of bricks by extrusion process already exists in the country. Therefore, the need of unifying the Practice being followed at present was also felt. This standard has been prepared to unify the practice followed by IS 11650:1991Guide for Manufacture of Common Burnt Clay Building Bricks.

- Preparation of brick sand.
- Mixing of waste with sand
- Moulding of bricks
- Drying of bricks
- Burning of bricks

Fig 1 Mixing of wastes

Fig 2 Moulding of Bricks

Fig 3 Drying of Bricks

Fig 4 Burning of Bricks

V. RESULTS AND DISCUSSION

TABLE 4 Compression Test

S.No	Sample	Compression Values (kN)	Compressive Strength (N/mm2)
1.	CS	100	5.76
2.	S1	150	8.67
3.	S2	145	8.57
4.	S3	170	9.06
5.	S4	130	7.60
6.	S5	115	6.40
7.	S6	140	8.00
8.	S7	110	6.50
9.	S8	120	6.80

TABLE 5 Water Absorption Test

Sl.no	Sample	Time (hrs)	Dry weight(kg)	Wet weight(kg)	Water absorption (%)
1.	CS	24	3.33	3.67	10.45
2.	S1	24	3.25	3.58	10.43
3.	S2	24	3.20	3.50	11.26
4.	S3	24	3.15	3.50	13.65
5.	S4	24	3.18	3.56	11.16
6.	S5	24	3.17	3.58	12.05
7.	S6	24	3.11	3.45	11.21
8.	S7	24	3.09	3.46	13.55
9.	S8	24	3.10	3.50	12.30

TABLE 6 Density Test

Sl.no	Sample	Mass (Kg)		Volume (m3)	Density (Kg/m3)
1.	CS	3.30	3.33	0.00154	2150
2.	S1	3.20	3.25	0.00154	2090
3.	S2	3.12	3.20	0.00154	2045
4.	S3	3.13	3.15	0.00154	2035
5.	S4	3.18	3.18	0.00154	2065
6.	S5	3.16	3.17	0.00154	2055
7.	S6	3.10	3.11	0.00154	2015
8.	S7	3.07	3.09	0.00154	2000
9.	S8	3.10	3.10	0.00154	2015

TABLE 7 Acid Resistance Test

Sl.no	Sample	Initial weight(kg)	Final weight(kg)	Loss in weight in (%)
1.	CS	3.02	3.09	8.4
2.	S1	2.95	3.05	7.8
3.	S2	2.92	3.01	6.1
4.	S3	2.97	2.98	5.0
5.	S4	2.98	2.99	5.9
6.	S5	2.93	2.95	6.3
7.	S6	2.85	2.87	7.6
8.	S7	2.82	2.84	8.0
9.	S8	2.85	2.83	8.2

A. Hardness and soundness test

- Scratch is made on the brick surface with the help of finger nail. If no impression on the surface, the brick is sufficiently hard.
- Two brick stuck with each other. Brick of good quality should not break and produce the ringing sound.

VI. CONCLUSION

Marble sludge and Bottom ash waste content up to 30 % by vol can be replaced in clay mixture, without degrading their mechanical properties. The presence of marble sludge and bottom ash allow one to obtain a clay brick with better properties as the conventional clay brick at low temperatures as the normally used for brick products in the brick industry, resulting in energy saving and waste reduction. The incorporation of marble sludge and bottom ash in brick production anticipates safe for the health an environmentally friendly recycling products.

Therefore, utilization of solid wastes has been encouraged as one of the most cost-effective alternative materials that could be used in fired clay brick manufacturing. Recycling industrial and urban waste in fired clay brick is useful if the correct percentages were incorporated and at the same time it would act as an alternative disposal method to the potential polluting wastes. Brick manufacturer will reduce the cost of raw materials, the usage of energy during firing and the improvement of the properties.

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INDUSTRIAL WASTE WATER TREATMENT USING *AZADIRACHTA INDICA* PLANT LEAVES

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ABSTRACT

Water pollution caused by harmful substances or waste effluents released from industries. It was a serious problem for the survival of living. since dyes were used to colour many industrial products and discharged directly into the water resources. Biosorption is a widely used technology for waste water treatment, especially for removal of pollutants that are not easily biodegradable. Plant extract based waste water treatment is useful for the removal of undesirable components which include both organic and inorganic matters as well as soluble and insoluble materials. This paper presents the comparative study of biodecolourization of both textile dye and bromophenol blue dye using *Azadirachta indica* leaves. Various concentration of dye was decolourized by *Azadirachta indica* extract and the concentration was measured at regular time interval. Finally it results in decolourized pure water within 1-2 weeks.

Keywords: Biosorption, Bio decolourization, blue dye, *Azadirachta Indica*, Concentration

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ELECTROCHEMICAL DECOLOURISATION AND DEGRADATION OF METHYLENE BLUE DYE USING AN ELECTRO FENTON (EF) PROCESS

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ABSTRACT

In this study the Methylene blue dye was decolourisation and degradation using Electro Fenton process using Ti, stainless steel electrodes. The effect of operating conditions such as pH, dye concentration, Fe^{3+} concentration, H_2O_2 concentration and current density, at regular intervals of time of the process was studied as the batch process in laboratory scale. The influence of operating parameters such as pH (2-9), dye (0.05–0.25 g/L), Fe^{3+} concentration (0.01–0.03 g/L), H_2O_2 concentration (0.1–0.5 g/L) and current density (0.1–0.5 mA/cm2), were analyzed by batch system. The optimum degradation conditions were determined as pH-3, concentration of dye-0.15 g/L, Fe^{3+} concentration-0.02 g/L, H_2O_2 concentration - 0.3 g/L and current density-0.3 mA cm^{-2}. These results indicated that the decolourisation efficiency of Methylene blue dye by EF process depends on solution pH and Fenton reagent concentration and a low pH value was favourable for the dye degradation. The decolourisation efficiency was investigated. The removal efficiency of the dye solution was reached It has been demonstrated that 91% dye removal was obtained at 50 min. Kinetic studies and COD removal efficiency were carried out for Electro Fenton process. The treatment process obeys the pseudo first order kinetic model. Electro Fenton processes were also investigated by Fourier Transform Infra Red Spectroscopy (FTIR), High Performance Liquid Chromatography (HPLC), Cyclic Voltammetry (CV) and GCMS (Gas Chromatography Mass Spectrum) were carried out to confirm the degradation and decolourisation of dye.

Keywords: Electrochemical Decolorization; Methylene Blue; COD removal; Electrodes

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Message from Thiru.M.Rajarajan B.E.,

International Conference on Innovations in Science, Technology and Management towards Sustainability (ICISTMS'17)

On this occasion, I congratulate ThiruR.Solaisamy, Managing Trustee and faculty members for bringing out an International Conference on "Innovations in Science, Technology and Management for Sustainability" in P.S.R. Engineering College. I am happy to note that about 43 participants from various countries viz., Egypt, Russia, Niger, El-Salvador, Zimbabwe, Laos, Fiji, Kyrgyzstan,Coted'ivoire, Oman, Iraq, Cuba, Sudan, Tanzania, Afghanistan, Bhutan, Zambia, Kenya, Namibia, Liberia, Vietnam, Botswana and Mauritius are going to present their papers. I wish the participants, faculty members and students to make use of this opportunity to learn about the technological developments in various countries and utilize them in their studies and research. I wish the conference a grand success.

Thiru.M.Rajarajan

Superintendent of Police,
Virudhanagar Dt.

National Institute of Technical Teachers Training and Research

[MINISTRY OF HUMAN RESOURCE DEVELOPMENT, GOVT. OF INDIA]
Taramani, Chennai - 600 113. India.

International Conference on Innovations in Science, Technology and Management towards Sustainability (ICISTMS'17)

Message from Director, NITTTR, Chennai

ICISTMS' 17 bring the academicians, researchers and industrialists together on a platform for exchange of scientific and technological information and initiates discussion, debate and dissemination of knowledge in field of Innovations in Science, Technology and Management towards Sustainability .This conference will help the researchers who work continuously towards the development of new ideas for the growth of human kind and to provide solutions to the various research problems. Another step of the conference is filling the gap between formal engineering texts and practically to promote academic interaction and faster collaboration. We hope that presentation of papers, suggestions and recommendations would help in better understanding of issues. This conference will go a long way in establishing the concept and disseminating the knowledge about the Innovations Science, Technology and Management towards Sustainability.

Prof. Dr. Sudhindra Nath Panda

Director

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INDEX

S.No	PAPER DETAILS	Page No.
1.	An Analytical Study of the Use and Application of Web Technologies in the Educational Sector of Mauritius	1
2.	Utilizing Data Science to Develop a Blood Genetics Disease Prediction System	2
3.	Significance Of Integrating Technology With Education In Liberia Schools	3
4.	Educational Technology Based on School Systems of Bhutan	4
5.	Review of Mobile Applications Development Methodologies	5
6.	Gamification: An Effective Tool for Teaching and Learning in the 21st Century	6
7.	Industrial Liquid Waste Management In Khartoum Industrial Area, Sudan Elshafei Mustafa, Osman	7
8.	The Use of Smart Materials in Green Buildings	8
9.	Climate Change in Fiji Islands – A Reality	9
10.	How is the World in the Future When the Us Withdraw from the Paris Agreement on Climate Change	10
11.	Conservation of the Biodiversity of Natural Enemies in Agricultural Farms in Cuba	11
12.	Exploring the Possibility of Using Sludge in production of Biodiesel	12
13.	SocioEconomic Impact of Firewood Energy Consumption in Southern African Households	13
14.	Swot Analysis for Implementing Sustainable Cities in Developing Countries	14
15.	State of Major Tuna Stock (Thunnus Albacares, Katsuwonus Pelamis and Thunnus Obesus) in an Atlantic East-Center Zone (Ivory Coast)	15
16.	Impact of Rangeland Improvements Practices on Sustainable Rangeland Management in Semi-Arid Area Umharoot Area-Sudan	16
17.	The Influence of Climate and Drought on Urban Tree Growth and the Implications for Future Growth Under Climate Change	17
18.	Challenges in Spatial Planning: A Case Study of Bulawayo City, Zimbabwe	18
19.	Gis Based Model for Optimal Location of Dustbins: A Case Study of Uasin Gishu Country	19
20.	Geographical Information System (Gis), A Vital Tool For Sustainable Development In Modern Urbanisation, A Case Of Municipality Of Chinhoyi, Zimbabwe	20
21.	Assessement of Hydro-Meteorological Monitoring Network Stations Using Gis: A Case Study of Cuvelai-Etosha Basin, Namibia	21
22.	Using Gis to Facilitate Visits to Tourist Attractions in the Capital City of Mauritius	22
23.	Implementation of Gis in Urban Local Bodies: A Case Study of Kwekwe City Council, Zimbabwe	23
24.	Hospital Site Selection in Khartoum City in Sudan Using GIS	24
25.	The Using Innovative Technology for Urban Planning And Monitoring	25
26.	Tsunami Impact And Evacuation Strategy Fo Grand Sable Village, Mauritius, Using Remote Sensing And Geographical Information System (GIS)	26
27.	To Control The Home Appliances Using Android Based Raspberry Pi	27
28.	Antioxidant Potential And Phytochemical Screening Of Leucas Aspera	28
29.	The Qualitative Analysis of Phytochemical and Hydroxyl Radical Scavenging Aetivity on *Cucumis Melo.*	29
30.	An Diagnosis of Victims with Vanet Environment using Image Processing Techniques	30
31.	A Contemporarynetwork Security Using Masquerade Ssl In Cluster Of Network	31

32.	K-Means Algorithm For Classifying And Segmenting Of Wbcs In Microscopic Blood Smear Images	32
33.	Forecast Score Based On Public Sentiment Analysis From Textual Reviews	33
34.	ANT Colony Optimization For Solving Job Shop Scheduling Problem	34
35.	Dual server public key encryption with keyword search for secure cloud storage	35
36.	Cloud Workflow Scheduling With Deadlines And Time Slot Availability	36
37.	Image Cloud Processing For Big Data	37
38.	Overview Of Bringing Size-Based Scheduling To Hadoop	38
39.	Application Aware Independent Deduplication For Big Data	39
40.	Classification of Quality using Fundus Images	40
41.	Content-Based Image Retrieval In The Cloud Image Mines	41
42.	Extract facial expressions from mouth region using novel image processing technique	42
43.	Chromosome Classfication Using SVM	43
44.	Smart Manufacturing Using Big Data Analytics: A Case Study In Casting Industries	44
45.	Water Resource Preservation In Agriculture Using Automated Irrigation System	45
46.	Impact of E-Learning on Achievement Of Stutdents In Science at Secondary Level	46
47.	Overview Of Bigdata In Cloud	47
48.	Qos Aware Secure Data Storage And Revocation Mechanism In Cloud Computing	48
49.	Divition and Replication Of Data In Cloud For Optimal Performance And Security	49
50.	Cost-effective privacy preserving of intermediate data sets in Cloud	50
51.	MRI Brain Tumour Segmentation Using Fet Optimization Algorithm	51
52.	Energy Efficient MAC Protocol With Clustered Nodes For M2m Networks	52
53.	Optimized Black Hole Attack Detection Mechnism With Reliable And Secured Routing In Manet Environment	53
54.	Real time healthcare monitoring system using IoT	54
55.	Aadhar based secure public places	55
56.	A Fault Tolerance Technique For Combinational Circuits Using MSR Logic	56
57.	A Hybrid Java Algorithm To Solve The Single Machine Scheduling Problems	57
58.	Automatic segmentation and classification of medical images using svm classifier	58
59.	Coupling suppression using latch type sense amplifier in sram	59
60.	Design And Implementation Of Low Power Cmos Dual Edge Triggered Flip-Flops Using Multiple C-Elements	60
61.	Design And Implementation Of Low Power Static Random Access Memory	61
62.	Design And Performance Analysis Of Compact Fractal Antenna For Swb Application	62
63.	Design of Controller for Load Management in Fuel Cell	63
64.	Design Of Fault Tolerant Division Unit Using Reversible Logic For Arithmetic Circuit Using QCA	64
65.	Design Of Microstrip Array Antenna For Wide Band Applications	65
66.	Design of T-latches based on reversible quantum Dot Cellular Automata	66
67.	Design And Implementation Of Mpptcontroller For Grid Connected Photo Voltaic System And Analysing Its Performances	67
68.	Design,Analysis And Implementation Of Ripple Carry Adder Using 8-Bit Full Adder In MGDI Technique	68
69.	Neural Network Classification of Single Channel Eeg Signal Analysis for EPileptic Seizure	69

70.	Performance Analysis of Time-To-Digital converter Based on Vernier Delay Line	70
71.	Secure communication using sha 5 in Wireless sensor networks	71
72.	A Novel Approach for Automatic Microcalcification Detection	72
73.	A study on work life balance among nurses with special Reference to Sivakasi Taluk	73
74.	Alumni Data Mart In Academic Erp: The Integration Of Repositories Towards Analytics	74
75.	Effectiveness Of Visual Merchandising Practices With Reference To Fashion World, Sivakasi	75
76.	Employees' Opinion Towards Working Environment with Reference to Sree Kannan Silks, Kovilpatti	76
77.	Properties of Hybrid Fibre Reinforced Polymer Composite	77
78.	Experimental Investigation Of Animal Bone Powder Replacing Cement In Concrete	78
79.	Experimental Investigation On Concrete By Using M.Sand And Quarry Dust As Fine Aggregate	79
80.	Experimental Study On Behavior Of Reactive Powder Concrete Recron 3S Fibers	80
81.	VLSI Based Color Interpolation For Real Time Video Applications By Using Csa Algorithm	81
82.	Efficient And Scalable Packet Filter With Finite State Automata	82
83.	Privacy Preserving Data Mining In Horizontally Distributed Databases	83
84.	Solar Tracking System For Coin Based Mobile Charger Using Atmel Microcontroller	84
85.	A Survey Of Appsmodels On Mobicloud Computing	85
86.	Work-Life Balance Of Software Employees In The Information Technology Industry In Chennai	86
87.	Electrostriction Effect Of An Aqueous Metformin Hydrochloride With Alanine	87
88.	Experimental Investigation On Cellular Foam Concrete Folded Panel	88
89.	Hierarchical Clustering With Best Fit Algorithm For VM Scheduling	89
90.	Reduction Of Fluoride In Drinking Water Using AzadirachtaIndica (Neem Leaves)	90
91.	Review On Membrane Bioreactor Technology In Sewage Treatment	91
92.	The Role Of Information Communication Technologies (Ict) In Education	92
93.	Security Enhancement In Manet Using Game Theory Approaches	93
94.	A Novel Approach For Portable ECG Recorder	94
95.	A Novel Fuzzy Approach For Load Balancing In Cloud Computing	95
96.	An Efficient Car Parking System Using Reservation In Vanet	96
97.	Enterprise Resource Planning Success Factors Model: A Structural EquationModelling	97
98.	Privacy-Protective Multi-Keyword Top-KSimilarity Search Over Encoded Data	98
99.	Rflicm: Reformulated Fuzzy Local Information C-Mean Image Segmentation	99
100.	The Sand Replacement In Concrete By Municipal Solid Waste Cum Generated Electricity	100
101.	Flipping Strategy:An Emerging Megatrend	101
102.	Identification And Assessment Of Delay Factors In Multi Storey Construction Projects	102
103.	Modelling And Analytical Studies Of Berthing Structures	103
104.	Self Compacting Concrete- A Review	104
105.	Sense Amplifier Half Buffer: A Low Power High Performance Asynchronous Logic QDI Cell Template Using Current Controlled Latch	105
106.	Storage Auditing And Regenerating Information In Cloud Environment	106
107.	Study Of Various Decision Tree Algorithms	107
108.	Training Effectiveness Among Employee's In Dharani Sugars And Chemicals Ltd, Vasudevanallur	108
109.	Using Balanced Data Distribution Scheme For Energy Hole Avoidance In UWSN	109

110.	Effective Utilization Of Ceramic Waste As A Raw Material In Concrete	110
111.	Employee Satisfaction Leads Increase Productivity In Textile Industries With Special Reference To Loyal Textile Mill Ltd, Kovilpatti	111
112.	Evaluation Of Mechanical Properties Of Natural Fiber Composites	112
113.	Experimental Investigation On Self Curing Concrete Using Pre-Soaked Light Weight Aggregate	113
114.	Ferrocement Box Beam	114
115.	Experimental Study On Bubble Deck Slab Using Geopolymer Concrete	115
116.	Experinmental Investigation Of Cellular Lightweight Concrete	116
117.	Experinmental Investigation Of Foam Concrete Wall Panel	117
118.	Review On Strength Properties Of Self Compacting Concrete By Using Fly Ash And Basalt Fibers	118
119.	Secure Location Determination Services On Mobile Devices	119
120.	Measurement Of Heartbeat Rate Using Video Magnification (VIDMAG)	120
121.	Experimental Study On Self Compacting Concrete With Partial Replacement Of Cement By Flyash	121
122.	Experimental Study On Mechanical Properties Of Recron Fiber Reinforced Self Compacting Concrete	122
123.	Experimental Study On Light Transmitting Concrete	123
124.	Experimental Study On Concrete In Compression Using Coconut Shell And GlassSand	124
125.	Experimental Study On Behaviour Of Concrete By Partial Replacement Of Cement With Glass Powder And Fine Aggregate With Quarry Dust	125
126.	Design Of Standard Cell Asic's Using Sense Amplifier Energy Recovery Flipflop	126
127.	Corporate To Educational Institution - Implementation Of 5S Model	127
128.	Study Of Self Compacting Concrete Using Reactive Powder	128
129.	Study On Flexure Behaviour Of Self Compacting Concrete By Partially Replacing Fine Aggregate With Ferrock	129
130.	Text Based Sentiment Analysis Using Hadoop Mapreduces Framework	130
131.	Analytical Investigation On Concrete Filled Elliptical Steel Tubular Column	131
132.	Utilizing Tailing Sand As Substitute Construction Material In Concrete	132
133.	Adaptive Delay Aware Algorithm For Mobile Data Offloading On Mobile Social Networks	133
134.	Effect Of Strength Properties On Concrete By Partial Replacement Of Fine Aggregate With Aluminium Waste	134
135.	Detection And Resolving Based Low Storage Clone Detection For Secure Data Transmission In Wireless Sensor Network	135
136.	The State Of The Art Analysis On Machining Parameter Optimization Of Metal Matrix Composite	136
137.	Optimal Number And Placement Of Wi-Fi Access Points With Regard To Real Environment Scenario	137

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IMAGE RETRIEVAL ORIENTED DEEP FEATURE LEARNING WITH COMPLEMENTARY SUPERVISION MINING USING ANN AND CNN CLASSIFIER

G.Deepa , M.Vimala

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ABSTRACT

In this paper presents investigates the problem of image classification with limited or no annotations, but abundant unlabeled data. The setting exists in many tasks such as semi-supervised image classification, image clustering, and image retrieval. Unlike previous methods, which develop or learn sophisticated regularizes for classifiers, our method learns a new image representation by exploiting the distribution patterns of all available data. Particularly, a rich set of visual prototypes are sampled from all available data, and are taken as surrogate classes to train discriminative classifiers; images are projected via the classifiers; the projected values, similarities to the prototypes, are stacked to build the new feature vector. The training set is noisy. Hence, in the spirit of ensemble learning we create a set of such training sets which are all diverse, leading to diverse classifiers i.e CNN and ANN classifier. The method is dubbed Ensemble Projection (EP). EP captures not only the characteristics of individual images, but also the relationships among images. It is conceptually simple and computationally efficient, yet effective and flexible. This project is implemented using Matlab simulation.

 ISBN: 9788193786062

VECTOR OFDM BASED POWER LINE COMMUNICATIONS FOR REDUCING SNR USING NON GAUSSIAN FUNCTION

M.RAJAVELMURUGAN, R. SENTHILGANESH

Department of ECE , P.S.R. Engineering College ,Sivakasi, Tamilnadu.

ABSTRACT

Most of the recent power line communication (PLC) systems and standards, both narrow-band and broadband, are based on orthogonal frequency-division multiplexing (OFDM). This multiplexing scheme, however, suffers from the high peak to- average power ratio (PAPR), which can considerably impact the energy efficiency, size, and cost of PLC modems as well as cause electromagnetic compatibility (EMC) issues. This project investigates the performance of vector OFDM (VOFDM), which has inherently better PAPR properties, over non-Gaussian broadband PLC channels equipped with two nonlinear preprocessors at the receiver. In addition, the low PAPR property of the VOFDM system is exploited to further enhance the efficiency of the nonlinear preprocessors. The achievable gains are studied in terms of the complementary cumulative distribution function of the PAPR, probability of noise detection error, and the signal-to-noise ratio at the output of the nonlinear preprocessors. For comparison s sake, the performance of conventional OFDM systems is also presented throughout this paper. Results reveal that the proposed system is able to provide up to 2-dB saving in the transmit power relative to the conventional OFDM under same system conditions, which eventually also translates into a system that is more resilient to EMC limits, reduced cost, and size of PLC modems. It is also shown that the achievable gains become more significant as the vector block size of the VOFDM system is increased.

 ISBN: 9788193786062

Distributed Group Communications in Mobile AD HOC Networks

M.Rajashanthi,
PhD Scholar,
Dr.K.Valarmathi,
Professor and Head of ECE Department,P.S.R.Engineering college,Sivakasi.

Abstract

Multicasting, in general, works well if the density of group members is sparse and in low mobility; broadcasting, in contrast, works well with a high density of group members and in high mobility. Due to the dynamics of the network, one strategy may be preferable to the other at different times and in different localized regions. In this paper, first list out the trade-offs between broadcasting and multicasting and evaluate the suitability of a strategy in various scenarios of deployment. Based on this, design a protocol that can change in response to the dynamics of the network. The protocol is named as Fireworks. Fireworks is a hybrid two-tier multicast/broadcast protocol. Fireworks increases the packet delivery ratio thus reducing the number of packet losses by detecting the link breaks earlier and finds a new path and send a message to the source.

Keywords Group communications, ad hoc networks, multicast, broadcast.

MULTIPLE CELL UPSET TOLERANT ERROR DETECTION AND CORRECTION CODE FOR SEMICONDUCTOR MEMORIES USING DSSC

N.SYoga Ananth , N.Pavithra

Department of ECE, P.S.R Engineering College, Sivakasi, Tamilnadu.

Abstract:

Errors that affect memories are a major issue in advanced electronic circuits. As technology scales, multiple bit errors become more likely. This limits the applicability of traditional protection techniques like Matrix code or single error correction codes that can correct only one error. Multiple errors tend to affect adjacent bits, and therefore it is interesting to use error correction codes that can correct adjacent errors. The issue with these codes that they require a large area and delay that limits their use to protect flip-flops in circuits. This project presents the implementation and evaluation of the Data Segmentation Section Code (DSSC), a new algorithm for the detection and correction of multiple transient faults in volatile memories with low cost implementation. .our proposed system has been coded in Verilog HDL and simulated using Xilinx 12.1

ECG SIGNAL CLASSIFICATION USING DCT-DOST ALGORITHM AND OPTIMIZED RBFNN CLASSIFIER

R. VASANTHA BASKAR , DR. VINOTH

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vasanthkarthic94@gmail.com,vinoth@psr.edu.in

ABSTRACT

Signal processing techniques are an obvious choicefor real-time analysis of electrocardiography (ECG) signals.However, classical signal processing techniques are unable to dealwith the nonstationary nature of the ECG signal. In this context, this project presents a new approach, i.e., discrete orthogonalstockwell transform using discrete cosine transform for efficientrepresentation of the ECG signal in time frequency space. Thesetime frequency features are further reduced in lower dimensionalspace using principal component analysis, representing the morphologicalcharacteristics of the ECG signal. In addition, the dynamic features (i.e., RR-interval information) are computedand concatenated to the morphological features to constitute thefinal feature set, which is utilized to classify the ECG signals using RBFNN based support vector machine (SVM). In order to improve the classification performance, optimization technique isemployed for gradually tuning the learning parameters of theSVM classifier. In this project, ECG data exhibiting 16 classes ofthe most frequently occurring arrhythmic events are taken fromthe benchmark MIT-BIH arrhythmia database for the validationof the proposed methodology. This project is developed using Matlab simulation.

IPv4 Packet Classification in Open Flow Network using Neural Network

B.Indira ,
Research Scholar
Dr.K.Valarmathi
Professor
Dept of Electronics and Communication Engineering ,P.S.R.Engineering College,Sivakasi-626 140

Abstract

Packet classification is a process to determine the flow of packets that depends on various fields of the packet header. Number of network services require packet classification for the provision of quality of service, routing, access control, traffic billing, etc. All these services require router to differentiate packets belonging to different flows. Existing techniques use longest prefix matching method to identify the packets matches with rule in the routing table. Searching complexity is the major limitations of the existing method. To overcome the search time complexity, machine learning techniques, namely Multi-Layer Feed Forward (MLFF) Neural Network and Radial Basis Function (RBF) is used. Various learning functions are analysed to reduce the Mean Square Error (MSE) and critical error in MLFF. In this paper, the multidimensional field is used as inputs and packets are classified based on classes labelled in the output layer. The simulation result shows that RBF network is found as the suitable network for classifying packets and this network achieved the overall classification accuracy of 99.86% with minimum error rate of 4.5%.

Key Words: Packet classification, multilayer feed forward neural network, radial basis function neural network, mean square error

DESPECKLING OF IMAGES USING MULIRESOLUTION TRANSFORMS WITH PATCH BASED TECHNIQUE

Rohinivijayakumar AP/ECE
P.S.R. Engineering College,Sivakasi.

ABSTRACT

Images are often corrupted by noise, Removing noise from the original image is still a challenging job for researchers, For visual quality as well as for satisfactory extraction of important features from the images, Despeckling of the images is necessary. There have been several numbers of published algorithms and each target to remove noise from original image. A recent development in this area of research is the use of multiresolution principles. In this paper, multiresolution HOSVD is proposed as a new method for denoising of images based on a patch based technique simply group similar patches together from a noisy images and transforms are applied for those images. Here the results based on various types of noise, such as Gaussian, Poisson s and Speckle performed in this paper. PSNR and MSE values are used to evaluate the performance of the transforms. The same method is extended to handle such varied noise models and evaluate the performance of the same.

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Message from Thiru.Kapil Kumar C. Saratkar IPS

It is a pleasure to know that P.S.R. Engineering College and National Institute of Technical Teachers Training and Research (NITTTR) are jointly organising the 'International Conference on Recent Trends in Engineering Education ICRTEE – 2K 18' in which 40 delegates from 22 different countries are going to brainstorm for two days. I am sure this will provide a forum for sharing and knowing the best practices adopted in the field of Engineering Education. This will go a long way in creating better future Engineers who will in turn make greater contributions in their fields making this world a better place to live. I am sure that the outcome result of this conference will be greater than the sum of the knowledge of us all. I wish all the delegates a happy stay and a fruitful conference

Kapil Kumar C. Saratkar

Deputy Inspector General of Police,
Tirunelveli

National Institute of Technical Teachers Training and Research

[MINISTRY OF HUMAN RESOURCE DEVELOPMENT, GOVT. OF INDIA]
Taramani, Chennai - 600 113. India.

Message from Director, NITTTR, Chennai

ICRTEE'18 bring the academicians, researchers and industrialists together on a platform for exchange of scientific and technological information and initiates discussion, debate and dissemination of knowledge in field of Engineering Education. This conference will help the researchers who work continuously towards the development of new ideas for the growth of human kind and to provide solutions to the various research problems. Another step of the conference is filling the gap between formal engineering texts and practically to promote academic interaction and faster collaboration. We hope that presentation of papers, suggestions and recommendations would help in better understanding of issues. This conference will go a long way in establishing the concept and disseminating the knowledge about the Engineering Education.

Prof. Dr. SadhindraNath Panda

Director

National Institute of Technical Teachers Training and Research
[MINISTRY OF HUMAN RESOURCE DEVELOPMENT, GOVT. OF INDIA]
Taramani, Chennai - 600 113. India.

Message from Conference Chair, NITTTR, Chennai

It is my great pleasure to address on the occasion of the International Conference on "Recent Trends in Engineering Education", which takes place in PSR Engineering College (PSREC), Sivakasi, Tamil Nadu, India on 05th October 2018. The conference would not have been possible without the enthusiastic and hard work of a number of colleagues. We are also grateful to all the authors who trusted the conference with their work.

Dr. S. Renukadevi
Professor & Head,
Department of Engineering Education

It is a great honor for me to address on the occasion of International conference on 05.10.2018 on "Recent Trends in Engineering Education". Our objective is to provide a forum for discussing the development, implementation, use and application of emerging technologies through this conference. Our institution is committed to add value to intellectual, moral, social and technological capabilities of a student. This Conference is an effort in the direction to give an exposure to the academicians on the recent development in our field.

Dr. P. Malliga
Professor
Department of Education Media and Technology

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INDEX	
S.NO	**PAPER TITLE**
1.	Women In Engineering Education In India
2.	Moving Forward: ICT In Education, Bhutan
3.	Innovative Practices In Teaching/ Learning For Technical And Vocational Education And Training - Mauritius
4.	Industry Demands And Future Of Engineering Education In Kenya
5.	Developing Intercultural Competence for Engineering Students
6.	The use of social media in education: A friend or foe?
7.	Strategies For Teaching And Learning Of Business Studies In Umuahia Education Zone, Abia State, Nigeria
8.	Promoting of women's mental health in Technical Education environment of Mexico
9.	Indigenous Knowledge in the Dynamics of Globalization Era: Evidence from
10.	The power of ICT in Tanzania Education
11.	Analysis of Gender Disparity in Technical, Scientific and Higher Education in Togo
12.	Development of Linkage Strategies To Attarct Women To Technical Training Through INADET And Its High Technologycal Training Centers In The State Of Chihuahua.
13.	A case study of E-Governance in SMEC, Afghanistan
14.	Exploring Effective training methods for Gender related issues
15.	Assessing The Need of Practicing Neurolinguistic Programming In The Inclusive Schools Of Bhutan.
16.	Women empowerment through entrepreneurship
17.	Embracing new media for political ,social and economic developement in Uganda
18.	Women Empowerment Through Political Participation and Leadership in Nepal
19.	Developing short course programme on Women Entrepreneurship Development in Mauritius
20.	Development of a woman empowerment cell and training in painting, making cake, fast food and making jewellery
21.	
22.	Developing Entrepreunerial Skills In Women
23.	Develop empowerment through the technical courses that IECA grants to women in Guanajuato, Mexico
24.	The Economic Importance Of Tourism In Africa : Case Study Of Niger
25.	Evolution Of Smart Pedagogies With Digital Gadgets
26.	Protection Of Three Phase Induction Motor Using Ardunio
27.	Analysis Of Network Attack And Mitigation Of Energy Times Of Wireless Nodes
28.	Privacy-Preserving Authentication Schemes For Vehicular Ad Hoc Networks: A Survey
29.	Voice Authentication Based E-Mail For Visually Challenged Survey
30.	A Cloud Enabled Social Media Networksites
31.	Implementation Of Time Series Methods In Wireless Ad-Hoc Network Using

	Intrusion Detection Detection
32.	Security Attacks And Challenges Of Wirelesssensor Network
33.	E-Blood Bank Application Using Cloud Computing
34.	Gwo Based Optimistic Feature Selection And Autonomous Prediction Of Liver Fibrosis
35.	Performance Analysis Of High Voltage Insulators In Power Transmission Network
36.	Raw Food And Fruits Quality Inspection System Using Iot And Image Processing
37.	Image Retrieval Oriented Deep Feature Learning With Complementary SupervisionMining Using Ann And Cnn Classifier
38.	Vector Ofdm Based Power Line Communications For Reducing Snr Using NonGaussian Function
39.	Application Of Outcome Based Education For Continual Quality Improvement - Case Study Of Principles Of Management
40.	Combination Of Cloud And IOT To Monitor Cardiovascular Disease Using Big Data
41.	A Dynamic File Storage Verification System For Cloudbased Big Data
42.	Distributed Group Communications In Mobile AD HOC Networks
43.	Cat Swarm Optimization Based Solid State Fault Current Limiter In DistributionSystem
44.	A New Improved Efficient LCGA Algorithm For Task Scheduling In Cloud Computing
45.	GWO based MPPT technique designed for photo voltaic modules under partial shading
46.	Performance Improvement of Induction Motor Drive Using Multilevel Inverter
47.	Design And Implementation Of Modified Cascaded Multilevel Inverter For Renewable Energy Source
48.	An Expert Agent System for Cloud Service Discovery Using Mfa Technique
49.	Multiple Cell Upset Tolerant Error Detection and Correction Code for Semiconductor Memories Using Dssc
50.	Minimizing Latency for Energy Balanced Routing in Wireless Sensor Network
51.	Achieve Secure Scalable Privacy Protection Based Access Control Scheme in Cloud Services
52.	Tribological Analysis On Coated And Non Coated Natural Fiber Composite
53.	Challenges of Ict In Teaching Learning Process
54.	The Role Of Biodiversity And Conservation
55.	Hybridization of Firefly and Lion Optimization Algorithm for JSSP
56.	Crop field monitoring and Irrigation automation based on IOT
57.	Implementation of Group Key Exchange Protocol in Delay Tolerant Networks
58.	Visually Challenged Person to Make Calls Using Haptic App
59.	Ecg Signal Classification Using Dct-Dost Algorithm And OptimizedRbfnn Classifier
60.	Adaptive Position Update for Measuring the Location of Nodes in Wireless Ad-hoc and Sensors Networks
61.	Survey of Cyber Security Issues in Smart Grid
62.	Forecast Score based on Public Sentiment analysis from Textual reviews
63.	An Diagnosis of victims with VANET Environment using Image processing Techniques

 ISBN: 9788193786062

64.	A study on Recent Advancement in Engineering Education System
65.	Optimal Group Key Agreement Scheme For Social Networks
66.	Real And Reactive Power Management In Distribution System For Unbalanced Conditions
67.	Customer Preferences Towards Suzuki Two-Wheelers: An Exploration Study
68.	Financial Performance In Kannan Enterprises, Salvarpatti: An Analysis
69.	An Analysis of Asset Management In Pandyan Grama Bank
70.	Risk And Return Relationship For Selected Stocks On Nse Using Capital Asset Pricing Model
71.	IPv4 Packet Classification in Open Flow Network using Neural Network
72.	Exhaust Gas Heat Recovery Power Generation System By Using Thermo Electric Generator
73.	Sustainable Fuel Products Through Pyrolysis Process.
74.	Reduction of Open Defecation By Modern Shelter Type Toilet For Rural And Slum People
75.	Three Axes Feed Programmable Cnc Milling Machine
76.	Automatic Door Controller
77.	Modelling Of Low Cost Three Axes Cnc Milling Machine
78.	Pedal Operated Deseeding Machine
79.	Automated Drainage Cleaning Robot
80.	Software Integration System For A Cnc Machine
81.	A scrutinization On Training Quality Offered In Driving Schools
82.	An Investigation Of Customer Expectation Level Towards Service Quality In Siva Auto Agencies, Sankaran Kovil
83.	Consumer Prreferences & Attitude Towards Service In Auto Agencies
84.	An Analysis Of Liquidity Management And Its Impact On Profitability In Match Industry
85.	An Analysis Of Financial Performance In Poly Board Industry
86.	An Analysis Of Cash Management In T-Square Hr Consulting Private Limited, Chennai
87.	Employees Opinion Towards Health And Safety Measures In Aruppukottai Sri Jayavilas Limited., Aruppukottai
88.	An Analysis Of Capital Budgeting On Selvakumar Fireworks
89.	An Analysis Of Working Capital Management In Textile Mill
90.	An Evaluation Of Financial Performance In Textile Mill
91.	A Study Of Consumer Perception Towards Aravindh Herbals
92.	An Analysis Of Capital Budgeting In Sri.Rajammal Agenesis
93.	An Analysis Of Working Capital Management In Jai Gangai Fireworks Industries, Thayilpatti
94.	An Analsysis Of Liquidity Positon Inp.K.M Construction
95.	An Analysis Of Brand Loylty Towards Raiyan Clothing
96.	An Analysis Of Cash Management In Canara Bank Kalampatti, Tuticorin Dist
97.	Classification Of Liver Tumor In Ct Images Using Deep Convolutional Neuralnetworks

98.	A Comparative Analysis Of Inventory Control Tehniques
99.	Effective Sequential Classifier Training For Svm-Based Multitemporal Remote Sensing Image Classification
100.	Execution Of Health And Safety Measures In Textile Industry:An Employees Opinion Survey
101.	Process Improvement Methodologies
102.	Role Of It In Strategic Management For Total Quality Management
103.	Movable Water Spray Irrigation System
104.	Mechanical Behaviour Of Self Compacting Reinforced Concrete Beams Strengthened With Hybrid Fiber
105.	A Review Study Onthe Effect Of Geotextiles On Cbr Strength Of Concrete Paved Road With Soft And Hard Subgrade
106.	A Review Study Onthe Effect Of Geotextiles On Cbr Strength Of Concrete Paved Road With Soft And Hard Subgrade
107.	Physical Properties Of Foam Concrete Using Fly Ash, Marble Sludge Powder,Ggbs
108.	Despeckling Of Images Using Muliresolution Transforms With Patch Based Technique
109.	Data Mining Approach For Anomaly Detection In Social Network Analysis
110.	Corrosion Study On Foam Concrete
111.	Analsis And Midigation Of Power Quality Issues Using Distributed Generation Based Custom Power Device
112.	Design And Fabrication Of Arduino Colour Sorting Machine
113.	Dual Sentiment Analysis: Considering Two Sides Of One Review
114.	Data Mining Performance Analysis For Effective Prediction With Different Techniques

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Bee Colony Based Sequential and Parallel task Scheduling in Cloud Environment

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Abstract - As the growth of energy utilization has been explosive in current data centres and cloud systems, it has drawn larger attention in academia, industry and government. And the high price of energy consumption has become a critical issue for these data centers. Task scheduling as a core in systems, it has become an important method to reduce energy dissipation. This method proposes a DVFS enabled Energy-efficient Workflow Task Scheduling algorithm: DEWTS. DEWTS can increase the CPU utilization of processors and reduce significant amount of energy consumption in a wide range of workflow structures compared among other researches. Through resorting the processors with their running task number and energy use, the underutilized processors can be joined by closing the last node and redistributing the assigned tasks on it. Experimental outcome show that DEWTS can decrease the total power consumption by up to 46.5 percentage for various similar applications as well as balance the scheduling performance. A large number of algorithms for scheduling real-time tasks have so far been developed.

Keywords: *Cloud computing* · *DVFS* · *Energy saving scheduling* · Heterogeneous · Heuristic algorithm

I. INTRODUCTION

Data centers have become the backbone of modern economy, from server rooms that power small- to medium-sized organizations, to server farms that maintain major companies and corporations, and to hyper-scale enterprise data centers that provide cloud computing service hosted by Amazon, Facebook, Google, and others. However, the explosive development of information technologies has also made data centers one of the fastest-growing consumers of electricity. Data center electricity consumption is expected to increase to about 140 billion KWH annually by 2020, equivalent to the annual output of 50 power plants, estimate American businesses 13 billion US dollars annually in electricity bills, and emitting nearly 100 million metric tons of carbon pollution per year. Electricity consumption cost has become an increasingly significant fraction of the total cost of ownership of existing and future data centers. The CPU power spend per cycle in a Complementary Metal Oxide Semiconductor (CMOS) processor can be expressed as

$$P = C_L f V_{DD}^2 \quad (1)$$

where, C_L is the total capacitance of wires and gates, V_{DD} is the supply voltage and f is the clock frequency. It is observable that a lower voltage level leads to lower power consumption. The price to give for lowering the voltage stage is that it also leads to a lower clock frequency and thus slows down the execution of a task. The relation among the clock frequency and the supply voltage is denoted as

$$f = (K \times (V_{DD} - V_{TH})^2 / V_{DD} \quad (2)$$

Where K is a constant which depends on gate size and capacitance and V_{TH} is the threshold voltage of the CMOS processor. The increased energy utilization causes severe economic, ecological and technical problems, such as the huge expense of power supply, the excessive carbon dioxide emissions, the problem of heat dissipation, etc. So it is important to study the strategy of reducing energy utilization in a HC system.

This paper is planned as follows: Section 2 discusses background and associated work. The problem statement and the energy and schedule length models are discussed in part 3. Section 4 describes the detailed tasks scheduling concepts using Bee Colony optimization. Section 5 presents the results and analysis of simulation. The conclusions and future work are stated in Section 6.

II. RELATED RESEARCH WORKS

Yan Wang,et al.,[1] proposed an optimal approach, i.e., an integer linear programming method, to solve energy-aware heterogeneous data allocation and task scheduling on various multiprocessor systems for real-time applications problem and

INTELLIGENT TECHNIQUES FOR FAULT DETECTION AND CLASSIFICATION IN GEARBOX

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Abstract—**Gears are one of the most common significant machine components in highly developed machines. Machine health monitoring and fault diagnosis have concerned substantial attention in both the speculative fields as well as the industrial applications.An improved perceptive of vibration signal is required for the premature detection of incipient gear failure of achieving high reliability.The vibration signal is descriptive of the behavior of periodic measures in the mechanical system.Vibration monitoring and analysis can be a useful part of a defensive maintenance program.**

IndexTerms—**Cement mill database, Discrete Wavelet Transform (DWT).**

I.INTRODUCTION

Gear systems are a necessary element broadly used in a variety of industrial applications. The gear sets are broadly used contrivance for power transmission in industrial applications. Shuen-De Wu et al. [1] Providing comprehensive and systematic review for brief the measurement techniques as well as fault diagnosis of bearing and gearbox systems. T.Y.Wu et al. [2] Direct DLF normalization combining HHT, is proposed to characterize the failures of a gear transmission system in case of variable rotating speed. Zhixiong Li et al. [3] The Wavelet transform (WT), Autoregressive (AR) model and Principal Component Analysis (PCA) has been for gear fault analysis. The virtual prototype dynamics simulation and experimental tests have been conducted and validate the efficiency. Tian-Yau Wu et al. [4] EEMD(Ensemble Empirical Mode Decomposition and AR modelling is proposed results display that the looseness fault at different mechanical components of rotating machines can be recognized with high precision. The study of mechanical vibration is thus the major technique for monitoring the operating condition and diagnosing the machine faults. Normally difficult to identify the looseness faults at different mechanical components. Shahin Hedayati Kia. [5] The stator current space vector instantaneous frequency (SCSVIF) has been commonly used for mechanical and electrical fault detection in gear system. Pramod et al. [6] A self-evolving maintenance scheduler (SEMS) framework for maintenance management of wind turbines and suggests an Artificial Neural Network (ANN) based condition monitoring method using data from SCADA. The ANN based condition monitoring used to estimate the condition of the gearbox bearings. Donatella Zappala [7] The SBPF (Side Band Power Factor) algorithm facilitates the monitoring analysis, falling each FFT spectrum to only one parameter for each data acquisition. By preceding the condition monitoring of the gears, the SBPF reduces the quantity of the vibration information that the wind turbine operators must knob, in case improved detection and decision making capabilities. Zijun Zhang et al. [8] Data mining algorithms and statistical methods are applied to analyze the jerk data conquered from monitoring the gearbox of a wind turbine. Ruoyu Li et al. [9] Acoustic Emission (AE) methods have been widely used in the field of rotational machine health monitoring and fault detection. AE features are extracted using the Empirical Mode Decomposition (EMD). Siliang Lu et al. [10] Sequential Multiscale noise tuning stochastic resonance (SMSTSR) to

Energy-Efficient Resource Allocation in LTE-Based MIMO-OFDMA System

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Abstract- The enormous energy consumption of wireless systems results in higher operational expenditure and also significantly contributes to the greenhouse gas emission and its effects. Higher energy consumption due to a large drain on the power of battery on using mobile equipment's. So, it is necessary to improve the energy efficiency of today's communication systems. To be applicable in LTE systems, both MIMO-OFDMA radio access network and Resource blocks (RBs) for sub-channel assignment are considered. In this Project the Energy-Efficiency is achieved by the Quasi Concave Optimization algorithm from the concept of the Lagrange Dual method. The Exhaustive search method is used only in limited constraint environments, when the problem size is increased in a rapid manner the algorithm would be changed to be quickly inflexible. So, Quasi Concave Optimization algorithm is proposed. It achieves a high user rate over the existing method.

***Index Terms*— Energy efficiency, resource allocation, MIMO-OFDMA, LTE, Greedy method, Quasi concave method.**

I.INTRODUCTION

To improve the energy efficiency of LTE cellular systems significantly from a holistic perspective, the radio access networks should be considered as the top priority, because the access segment can account for over 75 percent of the total energy consumption for typical cellular mobile systems. Regarding radio access networks, most existing works have focused on energy-efficient power allocation for diverse wireless channels. We concentrate on energy-efficient resource allocation in a MIMO-OFDMA systems based on LTE standard. Specifically, an optimization problem is formulated to maximize the energy efficiency with the metric of bits-per- Joule, subject to the user's QoS requirements in the form of user rate constraints. . Martin Schmidt [1] - It introduces the concept of a runtime-modelling, which allows to accurately conceptual many different transmission schemes while keeping additional complexity at a minimum and also increases the computational complexity for simulation. Gubong Lim [2] - The optimal resource allocation strategy for parallel transmission over multiple RATs by utilizing the intrinsic quasi concavity of the modified problem. Rebeca Estrada [3] - To achieve Effective spatial reuse between the macro cell and femtocell. The selection of base stations in two tier networks, assuming hybrid access FCs to, reduce the cross tier interference.QuanshengXu [4] - The problem of EE resource allocation for downlink communications in OFDMA networks that support heterogeneous services and EE resource allocation as a mixed combinatorial and non-convex optimization problem. To reduce the computational complexity, we solved the problem with three steps, where techniques such as BQPSO and some mathematical processes have been used. Christian Isheden [5] - A broad class of EE maximization problems can be solved efficiently, provided the rate is a concave function of the transmit power. A framework for solving EE maximization problems, which are different from the related problems of power minimization under rate constraints and rate maximization under power constraints.

XumingFang [6] - To minimize the total transmission power in a frame. Power-aware relay selection method is used to save energy. Relay stations may bring more energy consumption, it provides opportunities for network coding to save spectrum resources. Eunsung Oh [7] - To reduce their Operational Expenditure (OPEX). Energy efficiency with respect to base stations has been considered at all stages of cellular networks ,including hardware design and manufacture, deployment, and operation. Ioannis G. Fraimis [8] - A resource allocation algorithm which provides, QoS guarantees to users, in a cellular OFDMA network. The algorithm is a modified proportional fair (PF) scheduling algorithm and it comprises two phases. In the first phase, users rainimum data rate requirements are met and in the second phase, remaining resources are allocated according to a PF scheduling algorithm. CongzhengHan [9] - The Green Radio Program is to create innovative methods and to reduce the total energy. Cong Xiong [10] - The EE-SE relation in a single cell downlink OFDMA network, which is important for designing GR (green radio) networks that require a better balance between EE and SE. Large amount of greenhouse gas emission and high operation Expenditure.

A.LTE

Multiregion Image Segmentation Using Various Method

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Abstract— The Segmentation of the images refers to extracting the needed region from the image based on some specified methodologies. Edge detection, contour extraction, clustering are all segmentation methodologies. Hard C Means is the unsupervised learning algorithm. In this Hard C Means algorithm initially K number clusters are defined. Then K-cluster centers are chosen randomly. Then the mean or center of each cluster is calculated. Based on the distance between each pixels and cluster center, if the distance is close to the center, then move to that same cluster. Otherwise, compare to the next cluster. Also Hard C Means has some drawback. The main drawback is performance degraded by noise and computational complexity. This drawback can be overcomes by fuzzy c means. The fuzzy c means is one of the clustering based methodologies. The clustering methodologies can provide accurate results for most of the cases. As the number of clusters separated from the image increases, the segmentation accuracy also increases. It has been commonly used for segmentation of images. Compared with hard c means clustering algorithm it can retain more information in the image because of introducing fuzziness. This method will be demonstrated on medical images.

Index Terms— Segmentation, Hard C Means, Fuzzy C Means

I. INTRODUCTION

Segmentation is the process of excruciating a digital image multiple (sets of pixels, also known as super pixels). The aim of segmentation is to shorten and/or change the representation of an image into something that is more meaningful and calmer to analyze. Image segmentation is typically used to locate objects and boundaries (lines, curves, etc.) in images. More perfectly, image segmentation is the process of assigning a label to every pixel in an image such that pixels with the equal label part certain visual characteristics. Hard C-means clustering algorithm using the cluster center displacement between successive iterative processes to reduce the computational difficulty of conventional fuzzy k-means clustering algorithm. Fuzzy clustering is an approach operating towards fuzzy logic. It provides the flexible method of assigning the data points to the cluster. This process makes the image to have the same range of intensity in the whole image. An image linearization method based on wavelet domain gray stretch is proposed. Fuzzy C Means is unique of the soft segmentation methods which assign membership value to each cluster at every pixel and then using them to give the pixels to one or more cluster. (Bezdek, 1981). When compared with Hard C Means, Fuzzy C Means can hold more information because of introducing fuzziness for each pixel. In order to emphasize the gray stretch and edge improvements on the image, it syndicates the discrete wavelet transform with the principle of the largest between-class variance. Wavelet transform provides a special basis that a signal can express features easily and efficiently. Two dimensional DWT can be used to spoil an image into four sub image. The high-pass filter extracts the high frequency part and the low-pass filter provides the low frequency information representing the most energy of an image [10].

The hidden MRF-FCM (HMRF-FCM) algorithm is used to explore the spatial coherency modeling capabilities of MRF in the fuzzy clustering procedure. In order to exploit the multi-scale spatial constraints, they introduced HMRF-FCM into the wavelet domain and proposed the multi-resolution HMRF-FCM (MRHMRFFCM) algorithm. These methods make it possible to capture and utilize correlations over different image regions [11]. Adaptive Threshold-Based Shadow Masking to improve the accuracy of Panchromatic Quick Bird Images. Shadow recognition is the initial step after which effective shadow removal is achieved through mainly shadow correction or masking. GLCM features outperformed LBP features during across date classification, but LBP features were better for same-date classification with shadow masking using adaptive thresholding [9]. They construct an interval type-2 fuzzy set (IT2FS) with different fuzzy sets such that the length of the (membership) interval denotes the ambiguity of the trained with respect to the choice of the membership function. It has been extensively proven that a key point of fuzzy systems is to choose the correct membership function. From these membership functions, they construct an IT2FS and, by minimizing the IT2FS entropy and find a threshold with which to segment the image [6]. Divide altered images into grids of altered densities, and then use the gray value of each pixel in the image and the average gray value of the grid in which the pixel is located in as two components of the 2D histogram. A new multi-threshold segmentation method using extreme fuzzy entropy based on the proposed 2D histogram is presented to get two pairs of

Amplify and Forward Relay Network Improves the Security-Reliability Trade-off in Cognitive Radio Systems

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Abstract—Physical layer security is appear as a auspicious [illegible] of securing cognitive radio against eavesdropping [illegible] certain users, although the essential network connecting [illegible] origin to destination has better propagation conditions [illegible] the eavesdrop channel from origin to eavesdropper. Here, [illegible] and analyze the tradeoffs between the security and [illegible] of cognitive radio network in the presence of [illegible] attacks. We characterize the security reliability [illegible] of traditional relay selection scheme in the presence of [illegible], where the security and reliability are quantified in [illegible] of Signal to Noise Ratio and the achievable bit rate [illegible]. In order to improve the security reliability [illegible], we propose the fixed Amplify and forward algorithm [illegible] relay selection scheme. Overall, our task authorizes the [illegible] of developing concession between security and reliability [illegible] secondary transmission as well as the secondary reception [illegible] radio network.

Index Terms— **Security-reliability trade-off, relay selection, [illegible] attack, amplify and forward relay network, [illegible] radio**

I. Introduction

The security management of cognitive radio (CR) systems [illegible] have attracted increasing attention from the research [illegible]. Although highly dynamic nature of the CR [illegible] architecture, external attackers are increased and [illegible] the malicious behavior. Hence, the CR users fail to [illegible] characterize environmental behavior and may [illegible] compromised, which leads to a malfunction [3]. [illegible], CR networks face diverse security threats during [illegible] sensing [4], [5] as well as spectrum sharing [6], [illegible] mobility [7] and spectrum management [8]. [illegible] studies have been realized for take care of CR [illegible] both across primary user emulation (PUE) [9] and [illegible] denial of service (DoS) invasion [10]. Although PUE [illegible] DoS attacks present, eavesdropping is another main [illegible] in protecting the data confidentiality [11].

[illegible] layer security [12] is emerging as an efficient [illegible] for defending authorized users against [illegible] invasion by manipulating the substantial aspect [illegible] channels. In [13], Leung-Yan-Cheong and Hellman demonstrated that completely protected and decent communication can be achieved, when the wiretap channel spanning from the source to destination They also represent that the maximal secrecy capacity, is the difference between the capacity of wiretap channel and the main channel. In [14], represent the secrecy capacity limits the wireless fading channels in between the secondary cognitive radio transmitter as well as receiver. The secrecy capacity limits of wireless fading channels were further developed and characterized from an information-theoretic perspective, demonstrating the detrimental impact of wireless fading on the physical layer security. In order to conflict the dying effects, multiple-input multiple-output (MIMO) schemes as well as cooperative relaying and beam forming techniques were investigated for the sake of enhancing the achievable wireless secrecy capacity [15]. Although the extensive research efforts were devoted to improving the security of CR networks.

The major addition of this paper is compiled as below:

- We propose Amplify and forward (AF) relay algorithm based on both single-relay and multi-relay selection, for protecting the secondary transmissions against eavesdropping attacks also precisely, in the single-relay selection (SRS) scheme, only a single relay is chosen from the set of multiple SRs for leading the secondary transmissions from the ST to the SD. By contrast, the multi-relay selection (MRS) scheme employs multiple SRs for simultaneously assisting the Secondary transmitter and Secondary destination.
- We prompt the analytical SRT reasoning of the proposed SRS and MRS schemes in the presence of realistic spectrum sensing. Closed form expressions are derived for the signal to noise ratio (SNR) and bit rate for both schemes for transmission on the Rayleigh fading avenue. The numerical SRT results of traditional transmission method and proposed amplify and forward relay schemes are also provided for comparison purposes.
- The spectrum sensing accuracy is increased and the false alarm probability is reduced, the SRTs of the

Air Packed Balloon Robot for Crowd Disaster Management

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Abstract

There may be situations where it is common to meet hundreds of people at a time in a place even thousands or lakhs of people may gather at a particular place. Under such circumstances, it is difficult for anyone to manage such condition. It will lead to injure many people even sometimes it will lead to death of public. Mostly people will be over crowded during festive seasons or some other reasons that belong to any public parties etc. For example In January 15, 2011 there were 102 people died and 100 were injured during a stampede near sabarimala temple in Kerala. Similarly more devastated disasters took place in more places. Hence it is mandatory to avoid such condition and to prevent injuries or death that will occur to our public. The proposed research project aim is to prevent such condition by continuously monitoring the crowd present at a particular place and update the information time by time to the control center. The ultimate aim of this project is to ensure public safety were overcrowding will occur. Our project will ensure this by using an air packed balloon robot which will be fixed in a stand and from that place it will simultaneously monitor the crowd at a particular time. It will be programmed to inform that if the number of people in a particular place reach the maximum number (Will be preprogrammed in the robot),it will alert the security whom then go to that place and can easily manage the crowd at the particular place.

1. INTRODUTION

Crowds, or large concentrations of people, occur frequently in modern society. Occasionally venue inadequacies and deficient crowd management result in injuries and fatalities. The most crowded places are political meeting, railway station, Temple, shopping center, theatre, stadium, subways and etc. In January 15, 2011 there were 102 people died and 100 were injured during a stampede near sabarimala temple in Kerala. Recently, more than 40 people were injured in the crush that occurred in Godavari River at Rajahmundry in the state of Andhra Pradesh on July14, 2015.Hence, avoiding such a crowed disaster is an important to be addressed. The Figure 1.a) shows the crowds present in the railway station and trapped humans are represented as filled color as shown in figure 1.b). The stampedes will be formed like mass impulsive behavior, or a situation of panic, combined with deficient crowd management. For such big events like pilgrims, we need to add more staff. Volun may also be needed in some important spots to work police and other security is required to secure the peopl recent days the robotics is the discipline of emulating lives.

Figure 1. Crowds in Railway Station

Figure 2. Trapped humans

Only robot will be used to avoid this type of accidents. situation of congestion is put under the control of automat by using robot and monitors the affects during the crowd. proposed research project aim is to prevent such condition continuously monitoring the crowd present at a partic place and update the information time by time to the co center by using air packed balloon robot.

2. PROJECT DESCRIPTION

A robot is used in very less power usage and saf This robot is a moving robot which is used in particular cr places like temples, meeting and etc. Figure 2 shows block diagram for Air packed Balloon Robot. In this packed balloon robot, we are using the pressure sensor, h sensor. The project will reacts over the crowd which incr the normal pressure means it gives the beep sound via GSM module to monitoring system. In this project, we using the arduino board which act as a main controller of proposed model. The board is connected with pressure sen heat sensor and moving motors like steeper motor. The GS Module is interfaced with arduino board which is program using embedded C language. The robot is covered by packed balloons. Inside the air pack, it has particular pres and the temperature. This project is used to sense the pres in between the crowd. If there is increasing in crowd, peoples are dumped to the particular place. At that time pe giving a force on the air pack. Inside it, it has a presence of

Content Based Image Retrieval Using Curvelet and Wavelet Transform

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Abstract-**The large numbers of images have posed increasing challenges to a computer system to store and manage data effectively and efficiently. Content-Based Image Retrieval (CBIR) system overcomes the defects of traditional text-based image retrieval system, such as heavy workload and strong subjectivity. Text based image retrieval is searching of images based on related metadata such as keywords, texts and other elements that defined the image. This method is not only time consuming, but it is also dependent on the people who categorize it. GLCM is useful since it can contain three foremost elements, texture, histogram and edge information. GLCM provides the rules that grayscale of a pair of pixels appears at a certain distance away at a certain direction. In this an image retrieval system based on Curvelet transforms combined with gray level co-occurrence matrix is presented. This method uses texture as a visual content for feature extraction. Texture features are obtained on the Curvelet decomposed image. The results of the proposed method are compared with image retrieval using wavelet transform. This retrieval system performance is measured in terms of precision.**

Index Terms- CBIR, Wavelet transform, Curvelet transform, GLCM.

I. INTRODUCTION

An image retrieval system is a computer classification for browsing, searching and retrieving images from a bulky database of digital images. Most customary and common methods of image retrieval utilize some method of adding metadata such as captioning keywords or phantasmagorias to the images so that retrieval can be performed over the gloss words. Manual image gloss is time-consuming, laborious and expensive; to address this, there has been a large amount of research done on spontaneous image annotation. Additionally, the increase in social web applications and the semantic web have inspired the development of many web-based image annotation tools.

A content-based image retrieval (CBIR) method for analysis aid in medical fields. The images are indexed in a generic fashion, without extracting domain explicit features: a signature is built for each image from its wavelet transform. These image signatures illustrate the distribution of wavelet coefficients in each sub-band of the decomposition. A distance measure is then defined to relate two image signatures and thus retrieve the most similar images in a database when aquery image is acquiesced by a physician [1]. A method to excerpt color and texture features of an image rapidly for content-based image retrieval (CBIR). HSV color space is enumerated rationally. Color histogram and texture features based on a co-occurrence matrix are extracted to form feature vectors. Then the features of the global color histogram, local color histogram and texture features are compared and analyzed for CBIR [2]. The texture and color features are extracted through wavelet transformation and color histogram and the mixture of these features is robust to scaling and translation of objects in an image [3]. An important element of the Curvelet transform is to restore scarcity by reducing redundancy across scales. The discrete Curvelet transform makes use of a dyadic order of scales, and a bank of filters with the property that the pass band filter is focused near the frequencies [4]. A method is co-occurrences are computed through digital circles as an alternative to the standard four directions. They use discrete Fourier transform normalization to convert rotation dependent features into rotation invariant ones. They tested the four different datasets of natural and synthetic images [5]. Uses 2-D Discrete Wavelet Transform for reducing the Dimensions of test image and trained images. GLCM is applied for all tests and trained images of LL components of level 2 decomposed images to excerpt the texture feature of the images [6]. Present a method for content based image retrieval based on support vector machine classifier and get better result [7]. Introduce and assess GLCM features, i.e., contrast, energy, and homogeneity into CNN learning for GLCMs capability to recognize patterns with diverse variations, robustness to geometric distortion, and simple transformation and it does not require any prior segmentation process [8].

There are two approaches to image retrieval: Text-Based approach and Content-Based approach. Image retrieval techniques are useful in many image-processing applications. Content-based image retrieval systems work with entire images and searching is based on comparison of the query. General methods for image retrieval are color, texture and shape. These methods are applied to get an image from the image database. They are not anxious with the various resolutions of the images, size color and spatial distribution. Hence all these methods are not suitable to the art image retrieval.

AUTOMATIC SYSTEM TO TOTALLY AVOID ACCIDENT IN FIRE WORKS USING RASPBERRY PI

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Abstract-**The fire accidents are regularly occured in southern fireworks industries. When the temperature has risen the explosive materials can easily get fired. Its exploded and then spread into nearest working place of the industries. During the exploded time, fire needs some level of hydrogen to burn and after the level of hydrogen will be increased. The main objective of the project is to stop the occurrence of fire accident. A sensing and identifying system based on Raspberry pi with Internet of Things (IOT) technology.The Raspberry pi is a single computer board with credit card size that can be used for many tasks. The Raspberry pi board is a portable and low cost. Maximum of the raspberry pi computers is used in mobile phones. The IOT is the network of physical objects or "things" embedded with electronics, software, sensors, and network connectivity, which enables these objects to collect and exchange data. Also, it allows objects to be sensed and controlled remotely across existing network infrastructure. In this work, three modules are used such as Sensor module, Processor module and Prevention module. In senor module, temperature sensor can sense the room temperature, when it reaches the higher temperature level, the processor turns on the CO_2 gas valve and level of hydrogen content reduced. Hence the occurrence of fire accident had stopped by this device. The Processor module transfers the information from one device to another device. Prevention module includes input and output module. The input module is to connect the sensor and Raspberry pi. Then output module is used to receive the information from PC and monitor the temperature and hydrogen level.**

Keywords :Accidents, , Raspberry pi, PC, Hydrogen and Temperature sensor.

I.INTRODUCTION

The automatic system to avoid the accidents in fire works using Raspberry pi has a very wide range of applications [1-4], and multipoint detection is one of important research areas of Raspberry pi[5- 6].The network, that can be widely used in the areas human's life, Such as fireworks accident avoiding and other fields applications such as firework warehouse have strict requirements for temperature and humidity, therefore, to detect the temperature, humidity and Hydrogen in real time effectively in these areas is a very important issue. In order to ensure that the fireworks do not degenerate in the storage period or happens security incidents (such as spontaneous combustion, etc.), Maintaining the temperature and the relative humidity and set of Temperature level inside the fireworks is an important condition. The high temperature in warehouse would cause the pyrotechnic components contained in the fireworks break down easily; larger relative humidity would cause fireworks damp which will affect the quality of fireworks, and larger relative humidity would make fireworks absorb moisture and release exothermic, which would easily lead to spontaneous combustion; Higher Temperature level in firework Warehouse would cause the range also set in the Microcontroller processor. When it reaches the level, the Microcontroller automatically open CO2 gas valve and level Hydrogen content reduced in the region; every 10 degrees rise of temperature, the chemical reaction of the pyrotechnic accelerated 3-4 times, which would vulnerable to spontaneous combustion [7]. If the temperature level every 15degrees raise the quickly sparked a water of the Pyrotechnic at the time. Currently, the fireworks industry measures temperature and humidity and Hydrogen in fireworks commonly in the way of setting a number of thermometers and hygrometers in fireworks, and that

Monitoring and Controlling the Patients Using Zigbee

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***Abstract*—Patient monitoring systems is the term for all the various devices that are used to supervise patients. One category of such devices is devices that alerts if the patient gets into a critical state, In the existing Monitoring systems there is no system to monitor & initiate alert to doctors about the patients during glucose trip injections.in our proposed system there are 3 concept for trip injection ,when the liquid level below the threshold value it will rise alarm and intimate to corresponding person through wireless and flow level also to be controlled, then the any injection he applied means it will be automatically injected depends on time based. All the control to controlled through microcontrollers. And sensor used to measure the value of liquid, and other function based motor.**

I .INTRODUCTION

ACCORDING to the annual data report of 2013USRDS (United States Renal Data System), it indicates that the reported rates of incident end stage renal disease (ESRD) across the globe noticed an important trend. In 2011, the top three countries with the highest rates of reported incident ESRD are Jalisco (Mexico), United States and Taiwan. Furthermore, the top three countries with the highest rates

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The average inductor current is determined as,

common method of treating ESRD worldwide. In over 76 percent of reporting countries, at least patients are on this therapy method [1]. In addi reports that more than 90% of dialysis patients States are on hemodialysis therapy [2]. dislodgement has been reported to be a poten complication during the hemodialysis ther- apy American Nephrology Nurses' Associa- tion (A out an investigation on the venous needle dislo survey results revealed that 76.6% (n = 894) participants indicated about their observances of dislodgement in the past five years, and with those having seen five events or more in this Moreover, slightly more than half (57.9%) participants pointed out that venous needle occurs very often or often. An additional 23.1% concern as occasional [3]. From the above shows a high frequency of occurrence on dislodgement, and indicates that the dislodgement is indeed a potential hemodialysis therapy. A commercial blood leak HEMOdialert products [4], specific for hemodialysis currently available, which requires the sensing less than 1 ml of blood, and the blood leaking detected in 1 ~ 2 seconds. The sensing method based on the changes of the voltage signal in the device includes a detector having two spaced apart each electrode is connected to a signal generating lead. The device also includes a signal processing detects a change of state across the electrodes produ introduction of a fluid and an alarm actuated by the state. The electrodes are encased in a flexible non- material and can be reused after cleaning [5]. commercial product for the detection of blood available from Redsense [6] with a sensing approximately 1 ml of blood. The detection of a blood is by a change in electrical conductance in a circ comprises two metal wires separated by a slit. When flows into the slit, it creates an electrical connection

Ivrs Based Automatic Announcement System For Vehicle

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Abstract:- **In bus stands people feel very tricky to identify their particular bus. They need other's help to identify the bus. Talking signs, guide cane, echolocations are all useful in navigating the visually challenged people to reach their destination, but main objective is not reached that it fails to join them with traffic. In this project we propose a bus system through the voice alert system using RF Module. The microcontroller sends a data through RF transmitter. The RF receiver connected in the bus stand. It receives the data send to the processor. Interactive voice response system accordingly sends the voice announcement through the speaker.**

Keywords: **RF Technology, voice synthesizer.**

I. INTRODUCTION

The rise of various support-based organizations, more people have been given the opportunity to education and many other means. But still the issues of navigation for the elderly people are very complex and troublesome especially when they walked down in street and also navigate to distant places by public transport system. for visually impact persons, doing things such as reading traffic signals and street signs can be extremely challenging, if not it is impossible to do. Elderly people might use others help to identify their bus and also spot the stop.

In order to overcome these challenges, the sighted guide can be immensely effective, as well provide social comfort, but it restricts the independence of the people. Guide dogs and walking canes allow for a more independent means of travelling, but they are limited in unfamiliar environments. RFID is feasible and cost effective but it is more suitable for indoor communication only. Also it provides only one way communication and a very short range of Identification. A system with an augmented walking cane, a pair of augmented glasses and identifiable items tagged with semacode/data matrix tags is used for outdoor navigation of blind people. If a user has to take the bus, he walks along the pavement and his walking cane recognizes a tag. But the image quality of the web camera is fairly poor. Tag recognition in darkness or in bad lightning conditions might be a problem. Another issue is that camera needs a visual, so if a tag is hidden behind a person or another object, then the camera cannot detect it Tags on all environments will properly contaminate the environment and meet resistance from many citizens. Diravath Chander [1] blind to navigate their bus by alert system that is based on Zigbee. Zigbee have a less data rate and also used for short range communication. It is most suitable for indoor communication. It is used for one way communication and a very short range of identification. Jain PC [2] in this RFID tags are used for tracking the person which are required in 1000s of numbers for tracking of route. The system we use is a mobile unit. When the HM2007 matches the received speech signal to a specific stored phrase of word, the corresponding 8 bit value will be constantly held on the eight pins of the data bus. The 8 bit value will only change when the HM2007 recognizes a different speech signal. Therefore, the voice recognition components will always transmit a signal of the last speech signal recognized.

To overcome the drawback of currently available assistive devices, we proposed wireless sensor network system with RF technology for people identification by the bus and embedded system for providing the bus number, announcing the stops and showing the seats available in bus. RF transceiver designed for low power and low voltage wireless application so we can send or receive useful information through using this chip. Wireless sensor network consist of RF transceiver that continuously tracking the bus signal and send their data to the processor. Voice synthesizer (APR 9600) response to the processor data and announce which bus arrival to the bus stop and also display the bus stop name inside the bus. The software part is embedded c with Keil (operating system) for programming the controller. It is easy to use and includes a host of free software components for fast application development and super charged debugging.

II.MATERIALS AND METHODS

Power Supply

The above circuit shows the power supply circuit for +5V supply using 7805 IC regulator. This mobile handset unit

REGIONAL ENVIRONMENTAL MONITORING AND DETECTION SYSTEM USING GSM

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Abstract— **An intelligent system for monitoring and controlling of the grain condition is designed. Recently, as deteriorated buildings and airline system components such as high-rise buildings, chemical plant structures and accident planes and airline activities have various social problems and heavy economic loss due to its cracking, fire and collapse, it leads to national loss eventually. In order to prevent these problems in advance, this study intends to suggest test data control and efficient information provision service in structural safety test system using small flying type of (small kit) vehicles being mounted with multiple sensors. The system is based on embedded AT89C52 controller, using GSM for the lower machine control unit. The grain environment Information such as humidity, CO2 and fire concentration is collected and stored by Multi-sensor unit. Then the data is processed via multi-regional information fusion. The levels of the grain condition are predicted based on the sensor network. The article focused on the hardware circuit desiga of the grain condition intelligent monitoring system and the principle of the multi-regional weighted fusion. This project describes the design and testing of a group of sensors and communication systems based on GSM technology. Analog and digital sensor data is read using microcontroller. The sensor systems allow data to be sent from a remote location using WSN. The sensor systems have successfully gathered data from a variety of sensors including temperature, humidity, CO2 and fire sensors. The data is transferred to present any collected structural data in understandable format. The input and output functions status will be displayed on LCD.**

Keywords – **Intelligent System, ATMEL 89C52, Fire, CO2, sensors, microcontroller,**

I.INTRODUCTION

In the process of grain storage, temperature, CO2, humidity and Fire are the major ecological factors that can affect the grain quality. Therefore, the parameters of temperature, humidity, CO2, Fire must be in accurate and time monitoring by supervisory systems in large granaries. automatic monitoring of the grain storage will help improve the operation levels of grain storage, reduce the losses during stored procedure and reduce labor intensity. project designs an environment monitoring and control of the granary combining Embedded and GSM technol Using GSM to complete acquisition and transmissio environment parameters and using ARM7 to achieve pr control of the barn environment as system data controller using GSM to achieve the system's remote control, it g improves the flexibility and scalability of the ware management which sends available data to grain depot ma (Database management) in time and filters invalid data a spot. Grain is our county's important strategic resources. D the seasonality of its production, the storage of grain is th priority event which relates to people livelihood. Here, we still using our old method of storing the crops and beca this grains are spoiling soon. Also, we are unable to m the quality of the stored grains. The objective of this pro to designs an environment monitoring system of the g combining Embedded and GSM technology. Using GS complete acquisition and transmission of environ parameters and using ARM7 to achieve precise control of barn environment as system data controller and using GS achieve the system's remote control, it greatly improve flexibility and scalability of the warehouse management sends available data to grain depot manager each and minute grain condition will be monitored

II.RELATED WORK

Over the years, there have been several regulations by the Government to control the emission from vehicles, of them being unsuccessful at the same. The standards and timeline for implementation are set by the Central Pol Control Board under the Ministry of Environment & F Bharat stage emission standards are emission stan instituted by the Government of India to regulate the outp air pollutants from internal combustion engine equip including motor vehicles.

IOT based vibration sensing with Rasperri PI

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Abstract—**The world of home automation is an exciting field that has exploded with new technologies and today is known as an area where "The internet of things" (IoT) vision becomes reality. The primary advantages that stem from this concept include how each device forms a small part of the Internet, by which the advanced system is able to interact and Communicate, maximizes safety, security, comfort, convenience and energy-savings.We proposes an implementation of Sensor node as a part of IoT using a Raspberry Pi – inexpensive, fully customizable and programmable small computer with support for a large number of peripherals and network communication. Using this technology, in an example of monitoring and determining the confidence of fire in building, a full system, based on Sensor Web elements, is created and developed starting from a scratch. The advantage of Raspberry Pi – flexibility and extensive possibility of its usage.Our application is to sense the motor vibration and display in the PC**

IndexTerms—**Raspberry Pi, Internet Of Things(IOT)**

I. Introduction

The vibration signal is required for the premature detection of failure for achieving high reliability.The vibration signal is descriptive of the behavior of periodic measures in the mechanical system.Vibration monitoring and analysis can be a useful part of maintenance program.[1]Assessment Ofgear damage monitoringtechniques using vibration measurementsWilson Q. wangetal. [2]An electromagnetic, vibration-powered generator for intelligent sensor systems, is proposed to convert vibration energy into electrical energy for usein powering intelligent sensor systems. P. Glynne-Joneset al. [3]Subspace-based fault detection algorithms for vibration monitoring.The purpose of the paper is to describe and analyze new fault detectionwhich is more suitable for Miche'le Bassevilleet al [4] A review of vibration and acoustic measurement methods for thedetection of defects in rolling element bearingsThe study of mechanical vibration is thus the major technique for monitoring the operating condition and diagnosing the machine faults. Normally difficult to identify the looseness faults at different mechanical components. ShahinHedayati Kia. [5] The stator current space vector instantaneous frequency (SCSVIF) has been commonly used for mechanical and electrical fault detection in gear system. Pramod et al. [6] A self-evolving maintenance scheduler (SEMS) framework for maintenance management of wind turbines and suggests an Artificial Neural Network (ANN) based condition monitoring method using data from SCADA. The ANN based condition monitoring used to estimate the condition of the gearbox bearings. Donatella Zappala [7] The SBPF (Side Band Power Factor) algorithm facilitates the monitoring analysis, falling each FFT spectrum to only one parameter for each data acquisition. By preceding the condition monitoring of the gears, the SBPF reduces the quantity of the vibration information that the wind turbine operators must knob, in case improved detection and decision making capabilities. Zijun Zhang et al.[8] Data mining algorithms and statistical methods are applied to analyze the jerk data conquered from monitoring the gearbox of a wind turbine. Ruoyu Liet al. [9] Acoustic Emission (AE) methods have been widely used in the field of rotational machine health monitoring and fault detection. AE features are extracted using the Empirical Mode Decomposition (EMD). Silling Liet et al. [10] Sequential Multiscale noise tuning stochastic resonance (SMSTSR) to identify the train bearings faults in an embedded system over the acoustic signal analysis. Demodulate the original signal based on the Hilbert transform (HT). the multiscale noise of the demodulated signal is transformed to be an approximate distribution based on the Discrete Wavelet transform (DWT). Zhuang Li et al. [11] Discrete Wavelet transform (DWT) and an Adaptive resonance theory,neural network for fault detection of a gearbox. DWT for feature extraction and adaptive resonance theory,neural network for recognizing crack faults. Fault detection via time-domain analysis only is difficult to obtain. Fafa Chen [12] Empirical mode decomposition (EMD)

An Automatic Motor On/Off and Monitoring the Irrigation Process

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Abstract—**With the advancement in technology, the world around us in every part of our life getting automated. The manual procedures are being replaced by these automated systems, since they are with energy efficient and consume less labor work. This paper proposes the advantages of having Wireless Sensor Network technology in Indian agricultural sector, which shows the path to the rural farmers to replace some of their traditional techniques. Here, environmental data such as moisture content of soil is collected by a wireless sensor node and applied as input to the Peripheral Interface Controller (PIC). The data is checked continuously by PIC controller and a set of control actions like automatically on for Irrigation, are made if they exceed threshold level automatically motor off . The system overcomes the limitations of traditional agricultural procedures by utilizing water resource efficiently and also reducing labor cost. Through the wireless camera you see the field through the laptop.**

Keywords: agriculture, moisture sensor,wirelesscamera.

I. Introduction

During the last decades, remote sensing has been an extremely important source of information to improve human knowledge about the dynamical process occurring in our planet. In particular, data from both optical sensors [1]–[3] and radar systems [4]–[6] have been applied to agricultural crop monitoring. In this context, timely and spatially fine information about the condition of crops is an increasing demand from both farmers (to help precision farming methods) and institutions at different spatial levels (to improve yield forecasts or to ensure environment-friendly practices). Farming management by growth stage is critical in optimizing returns from inputs such as nitrogen (N), plant growth regulator (PGR), fungicides, and water. For instance, the key growth stages for fungicide application are often within the stem elongation stage, and any variation in the application timing can affect the final yield [7]. To provide such a frequent update of information, optical data [8], [9] have an inherent limitation when cloud cover is present.In this paper, the phenological process of a crop, i.e., its growth or development, is interpreted as a dynamical evolution, which responds to an unknown analytical model that depends on a huge number of variables, such as temperature, humidity, irrigation, soil conditions, solar irradiance, etc.

A methodology is proposed to extract the evolution model of a generic crop, either for the phenology or any other biological process, in a first stage. The final objective is to exploit the created model to estimate, in a second stage, the growth stage where a particular crop field is. In order to develop the potential of remote sensing acquisitions, the estimation step is carried out in real time. This means that as soon as new input data are available (e.g., a new satellite image is acquired), the estimation is applied; hence, it is not necessary to perform the estimation over the whole temporal series.

II.Materials and Methods

Power supply : A power supply provides a constant output regardless of voltage variations."Fixed" three-terminal linear regulators are commonly available to generate fixed voltages of plus 3 V, and plus or minus 5 V, 9 V, 12 V, or 15 V when the load is less than about 7 amperes.The "78xx" series (7805, 7812, etc.) regulate positive voltages while the "79xx" series (7905, 7912, etc.) regulate negative voltages. Often, the last two digits of the device number are the output voltage; eg, a 7805 is a +5 V regulator, while a 7915 is a -15 V regulator. The 78xx series ICs can supply up to 1.5 Amperes depending on the model.This circuit is a small +5V power supply, which is useful when experimenting with digital electronics. Small inexpensive wall transformers with

Automatic E-vehicle recharge system

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Abstract— **An electric vehicle (EV) is a vehicle that does not rely on gasoline or liquefied petroleum gas as fuel but only uses electricity stored inside the car battery as the source of kinetic energy; hence, it offers emission-free urban transportation. The main objective of our project is to recharge electric vehicles by implementing charging stationand on the otherhand renewable energy (solar) is also used to charge the batteries present in the EV. Electric motors are used instead of a gasoline engine to accelerate the EV. Here a new payment system is proposed for EVs. The price for charge retrieved by the battery from the charging station will be paid through smart card. This system supports privacy protection.**

IndexTerms—**RMO(Routing with minimum overhead), DMO (decomposition of minimum overhead),Multipath.**

I .INTRODUCTION

AN electric vehicle (EV) is a vehicle that does not relyon gasoline or liquefied petroleum gas as fuel buonlyuses electricity stored inside the car battery as the source of kinetic energy; hence, it offers emission-free urban transportation.It uses an electric motor instead of a gasoline engine to accelerate. The battery can be recharged by the common household electricity for normal charging (slow charging) or by the specifically designed charging station for fast charging.There are many advantages of using EVs. For example, EVs do not emit harmful tailpipe pollutants from the onboard source of power at the point of operation (zero tailpipe emissions). If renewable energy (such as solar or hydroelectricity) is used, the EV becomes a renewable form of transportation Future EVs may support a vehicle-to-grid (V2G) system.

This concept allows vehicles to provide power (sell electricity) to the grid. This can be done if an EV is equipped with a solar panel and is parked outside in sunshine. In this way, the EV can help to balance loads by "valley filling" (charging at night when the demand is low) and "peak shaving" (sendingpower back to the grid when the demand is high). It can enable utilizing new ways to provide regulation services (keeping voltage and frequency stable) and spinning reserves (meeting sudden demands for power). In the U.S., EVs have started to become popular due to the advantages that it can offer. The Department of Energy's eGallon provides comparison in terms of cost to commute to work or drive across town, by posting at every corner gas station on how much the EV drivers can save on fuel by using electricity instead of gasoline. Essentially, it compares the cost to drive an EV and a traditional gasoline-based car. On average, fueling a gasoline-based car will cost roughly three times more than fueling it with electricity, i.e., in the case of EVs. In addition to saving money, EVs also offer significant environmental benefits, which makes the adoption of EVs very attractive. Despite their potential benefits, widespread adoption of EVs faces several hurdles and limitations. One of the major problems is the driving range. Most EVs can only go about 100 to 150 km before recharging, whereas gasoline vehicles can go over 500 km before refueling.

This may be sufficient for city trips or other short hauls. Nevertheless, people can be concerned that they would run out of energy from their battery before reaching their destination, which is a concern known as the range anxiety. One of the solutions is to install more fast-charging stations with high-speed charging capability so that consumers can recharge the 100-km battery of their EV to 80% in about 30 min. EV drivers may then charge their vehicles at their homes, offices, shopping malls, or car parks outside restaurants where they are having dinner.

II. SYSTEM ARCHITECTURE

A power supply provides a constant output regardless of voltage variations ."Fixed" three-terminal linear regulators are commonly available to generate fixed voltages of plus 3 V, and plus or minus 5 V, 9 V, 12 V, or 15 V when the load is less than about 7 amperes. The "78xx" series (7805, 7812, etc.) regulate positive voltages while the "79xx" series (7905, 7912, etc.) regulate negative voltages. Often, the last two digits of the device number are the output voltage; e.g. 7805 is a +5 V regulator, while a 7915 is a -15 V regulator. The 78xx series ICs can supply up to 1.5 Amperes depending on the model.This circuit is a small +5V power supply, which is useful when experimenting with digital electronics. Small inexpensive wall tranformers with variable output voltage are available from any electronics shop and supermarket. These transformers are easily available, but usually their voltage

SMS CONTROLLED SMART E-NOTICE BOARD USING GSM

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stract— To make the notice boards easy to use and ore technically advance, I have used this prototype wireless notice board where we can display the ssage by simply sending the message through your ll phone. A GSM module is used here for the reless notice board to send the information or ssage to display. The main aim of this project is to e time and provide information urgently on play for the customers. It can be used for multiple rposes like we can share live share market news, can send trains time table to display, we can show tures time table and important information for dents and for teacher in school and college. In this cuit GSM module and a 16x2 LCD display is used r receiving message and display message pectively. When any urgent information is to share h more people this system works perfectly. When yone wants to show any information or message, n sender sends a SMS to GSM Module. Then duino reads the GSM module and send it to the D. This project can be improved by using a larger play module.

dexTerms— GSM Module, Display Board, EEPROM, cro Controller.

I .INTRODUCTION

Now a days poster is going digital. The big shops the shopping centers use digital displays now. Also, in ns and buses the information like platform number,ticket rmation is displayed in digital boards. People are now le to order to the idea of the world at its finger-tips. The mobile phones have increased severely overyears. rol and communication has become important in all the s of the world.This gave us the idea to use mobile phones ceive message and then display itom an electronic board. GSM technology is used. GSM stands for Global tem for Mobile Communication. Due to this rcontinental roaming capability of GSM, we can send sage to receiver from any part of the world. It is has the system for SMS(ShortMessage Service).This project is a in the sticks notice board with a GSM modem at the receivers end.So if the user wants to display any message, we can send the in sequence by SMS and thus keep posted the LCD display as a result. A 16x2 Character LCD display is attached in byte mode to port 1 of microcontroller. This display will be used to display the messages /advertisements. PC Coding will be done using VB. Nokia PC Connectivity SDK is a tool used in VB for GSM SMS is then extracted by PC with the help of a V

B program using AT commands. SMS are then sent to microcontroller using MAX232 IC and PC's ongoing port. Microcontroller finally displays it on LCD display. This project plans at integrating the bulk of a wireless cellular network and the ease of information transfer through the SMS with the coverage of public display boards. complete potential of public display boards in straight information broadcast in quick answer to events of interests.

II.DESIGN LAYOUT

A.Microcontroller

Microcontroller is a small computer on a single integrated circuit containing a processor core, memory and programmable I/O peripherals. We have used microcontroller (Arduino). Arduino is an open source. An arduino board historically consists of an Atmel 8-,16 or 32 bit AVR Microcontroller with Complementary component.The

Splat Based Hemorrhage And Blood Vessel Segmentation In Retinal Fundus Images

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Abstract— **Diabetic Retinopathy (DR) is a medical condition caused by fluctuating insulin level in the blood which causes vision loss in case of severity. Timely treatment of such risks requires identification of the first clinical symptoms like microaneurysms (MAs) and hemorrhages (HMAs). The presence of those symptoms are visible in the digital color photographs of the retina and appear as round dark red spots in the image. In our propose approach for segmentation of retinal blood hemoherrage areas & vessels towards the diagnosis of proliferative diabetic retinopathy (PDR) from digital fundus images. Here, 2D-Match (Gabor) filters are used on digital fundus images in which the vessels are enhanced by contrast-limited adaptive histogram equalization (CLAHE). Here we use Adaptive Graphcut method for segmentation of hemoherrage area and vessels accurately. A double sided thresholding scheme is then used to segment the vessels. Hysteresis thresholding is performed with the large and small vessels clipped at different intensity levels in order to reconstruct the vessels in the image. We conclude the blood vessel extraction accuracy and elapsed time with visual extraction of retina fundus image. Finally we classify the segmented features with Support vector Machine Classification for improved the segmented accuracy.**

Index Terms— **Diabetes Mellitus (DM),Microaneurysms, hemorrhage, Retinopathy of prematurity (ROP),thresholding**

I. INTRODUCTION

Diabetes Mellitus (DM) is the name of a Chronic, Systemic, Life- Threatening Disease. CausesThe recent increase in Diabetes can be attributed to an aging population and increasing prevalence of obesity as well as a sedentary life habits.Effects: Diabetes affects the kidney, eyes, nerves and heart. Diabetic Retinopathy:Diabetes mellitus often results in Diabetic Retinopathy which is caused by pathological changes of the blood vessels.Which nourish the retina. DR is the main cause of new cases of blindness among adults aged 20–74 years. The visual effects of this leakage are features, such as microaneurysms, hemorrhages,hard exudates, cotton wool spots or venous loops of DR .Types of Diabetic Retinopathy DR can be broadly classified as Nonproliferative DR (NPDR) and Proliferative DR (PDR).Rohini Roychoudhury [1]. Tophat reconstruction,

Adaptive thersholding segmentation of blood vessels from image is a difficult task due to thin vessels. M.Usman akram [2] 2Dgabor filtering,multilayered thersholding The blood vessel segmentation accuracy is 94.85%. J.Jan,J.Odstrilik [3]. Texture analysis, 2D matched filtering ,NFL detection. NFL detection is very difficult. Luca Gan Cardo [4]. Exudates segmentation, feature selection,lesion probability ,automatic diagnosis, wavelet decomposition. Most of the reported systems are highly optimized with respect to the analyzed fundus images, generalization of individual result is difficult. Cemal kose, Ugur revik [5] Automatic diagnosis of DR,automatic segmentation ,background image extraction,medical image, analysis Operation of matched filter is very difficult. Thomas walter [6] Microaneuryams detection,diameter opening,attribute opening,criteria based operators,mathematical morphology,lesion detection,shade correction,density estimation It requires several process to detect the microaneurysms M.Elena Martinez [7] Multiscale feature extraction,region growing,blood vessel segmentation. Difficult to segment blood vessel in Red free and flurosein images.

The rest of this paper is organized as follows. Section II describes the existing system for tortuosity in retinopathy of prematurity disease using morphological processing, segmentation and screening. Section III then introduces the proposed graph-cut algorithm,macro and micro blood vessels are detected. Next, Section IV evaluates the performance by simulation of the proposed splat base feature extraction of vessel and detection.Conclusions are finally drawn in Section V.

II. EXISTING SYSTEM

Detection of minute blood vessels and hemorrhage detection are very difficult in retinal fundus images.Because it seems like nerves . Normally blood vessels and nerves are in same size. We can't easily different nerve and blood vessels. Sometimes minor blood vessels are not visible in fundus images. In existing system, they measured the changes in blood vessel width and tortuosity in retinopathy of prematurity disease using morphological processing, segmentation and screening .In reality Infants areaffected by this disease. Measurement of vessel width and tortuosity is less accurate. Measurement of PSNR and MSE value is also less. Segment Hemorrhage Detection in Fundus Images using Splat based feature extraction methods. Segment the blood vessels (hemorrhage retinal image) with SVM classifier in fundus retinal images.

Modeling of PEM Fuel Cell

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Abstract— **The use of fuel cell based power generation system is expected to become more wide in our future due to its reliability, portability and ecological constraints. FC technology for electricity and heat generation for residential applications generated tremendous interest proton Exchange Membrane FCs (PEMFCs) are attractive for residential use due to its low operating temperature and fast start-up characteristics. This paper focuses on modelling and simulation of PEMFC based power supply system.**

Index terms— **Proton exchange membrane (PEM) fuel cell (FC), modelling of PEMFC.**

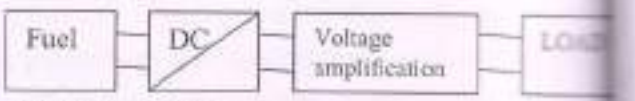
I. INTRODUCTION

Fuel cells combine hydrogen and oxygen to produce electricity and water. Hence they are the most sustainable sources of electricity future. The chemical energy is converted to electrical energy directly by the fuel cell. Continuous supply of hydrogen and oxygen is required for the operation of fuel cell. The fuel cell is a static power conversion device and produce dc power as output. Water vapour which is a non pollutant is the only exhaust of the fuel cell if pure hydrogen is used as fuel. The efficiency of conversion is better as the chemical energy is directly converted to electricity without intermediate conversion. Fuel cell is a new technology to produce energy without causing environmental pollution and noise, which is a combination of direct fuel and oxidants, and can produce electrical energy with high efficiency. The main reason for rushing the FC technology toward commercialization include fuel availability, modularity and cleanness of FC based power generation. FCs are capable of GENERATING both electrical and thermal energy. Among the various types of FCs, proton exchange membrane FCs (PEMFCs) are particularly attractive for residential use due to their relatively low operating temperature (~80 C) and good dynamic response. An FC based power system mainly consists of a fuel-processing unit (reformer), FC stack and power conditioning unit. The FC uses hydrogen as input fuel and produces dc power at the output of the stack. The performance of the stack is expressed by the polarization curve, which gives the relation between stack terminal voltage and load current. It is evident that the cell voltage decreases almost linearly as the load current increases. Therefore, the output voltage should be regulated at a desired value. To keep the polarization characteristic at a constant level, parameters such as cell temperature,air pressure, oxygen partial pressure, and membrane humidity needs to be controlled.

In this paper, we selected a commonly used 5-kW (48-V) FC, a single-stage-voltage-sourced pulse width-modulated (PWM) inverter followed by a low-pass filter and a step-up transformer to perform voltage and real power control with respect to residential load variations. It is assumed that the FC output voltage ranges from 40 to 70V. The simulation is performed based on the standard home appliances such as refrigerator, TV, microwave oven, washing machine, air conditioner, etc., as loads.

II. MODELING OF PEMFC

In order to obtain the performance of the fuel cell it is modelled and dynamically modelled.



Fc low dc voltage Inverter

Fig 1. Voltage amplification topologies for FCs

STATIC MODEL

The performance of a fuel cell is generally characterized by using the polarization curve. This is a plot of the FC voltage versus load current. The main factors which affect the polarization curve are cathode pressure, reactant gas pressure, cell temperature and membrane humidity. The polarization curve is computed by using the equation, which subtracts the various voltage losses from the open circuit FC voltage and is expressed as,

$$V_{dc\ stack} = V_{open} - V_{ohmic} - V_{activation} - V_{concentration}$$

2.1 NERNST VOLTAGE

Nernst voltage or reversible voltage that exists at no-load condition for a given temperature and pressure.

$$V_{open} = 1.229 + (T-298)(-2.302*10^{-4}) + 4.308*10^{-5}\ T\ln(P_{H_2}P_{O_2}^{0.5})$$

2.2 ACTIVATION LOSS

Security system for Base Transmission Station using Raspberry Pi

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Abstract— **In the present age security is a major concern in our day-to-day life. The BTS equipment are usually housed in a shelter which protects the telecom equipment from external condition such as Dust, Corrosion, rust, theft etc. Introducing the Raspberry Pi to the world of BTS (Base Transmission Station) provides several customizations. The main objective of this project is to be controlled and monitored by the Raspberry pi. It makes simple, fast and reliable way to automate their environment. This project focuses on BTS security system.**

Index Terms— **Raspberry Pi (RPi).**

I. INTRODUCTION

The Raspberry pi is an advanced platform of automating a base station. It is a minicomputer sized and it has a different input and output. In input section there is temperature sensor, PIR sensor and wireless camera.Raspberry pi is equipped with Wi-Fi dongle.

A PIR sensor is placed on door and it detects the movement of human. If any unauthorized person enters in front of the door this sensor identify the motion of that person and will transmit information to raspberry pi.

The wireless camera is connected to the Raspberry pi. It capture the image of the person entering in to the base station and it sends the information to the user.

The Organization of the paper is as follows: Section II gives Hardware & Software Code sign In Section III gives the Implementation of Hardware & Software Code sign. We conclude in Section IV and with some comments on future work.

II. HARDWARE PROTOTYPE

The Hardware and software code sign of today's systems to Trade-off performance, power and dependability in multi-core processors. In Software based techniques are severely limited by observability and control ability of the hardware due to strict abstraction layers. This gives rise to the problem of matching the performance requirements of a specific application of a processor.

To interface the PIR sensor with Raspberry Pi , we are using GPIO(General Purpose Input/ Output) Pins. Using the RPi.GPIO library in python it gets the basic PIR sensor talking to the Pi[2]. Firstly we have added a method that will send a

A. RASPBERRY PI

The major component used in this system is the Raspberry Pi. The Raspberry Pi is a wonderful platform that can be used to build your Base Transmission Station (BTS) security system. Raspberry pi is a credit card sized small board computer. Raspberry Pi module runs on Linux OS. It boots and runs by the SD card. It does not have any internal memory. The GPIO pins of the raspberry pi were programmed using Python programming language[6]. This Python language is the easy language to run on the Raspberry Pi with various applications.

B. Passive Infrared Sensor

The Passive Infrared Sensor is simply called as PIR sensor. All living beings radiate energy in the form of infrared radiations and these radiations are not visible for human eyes. A PIR sensor is mostly used for detect motion and passive radiations. When an animal or human emitting infrared radiations passes through the field of view of the sensor.

The PIR sensors have three pins. There are ground, digital out and 3-5VDC in. The PIR sensor has range of approximately 3 to 7 meters, so it is great for monitoring a door or corner of a room.

DIGITAL CMOS CIRCUITS OPERATING NEAR THRESHOLD BASED ON A COMPACT TRANSREGIONAL MODEL

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Abstract— **In digital circuits power dissipation is currently one of the most important design constraints.Existing model is MOS device that is too complex and obscuring the basic physical relations between voltage and current that's why we are using CMOS circuits,which is necessary to reduce the supply voltage to near the device threshold voltage.digital CMOS circuits based on compact transregional model for analyzing digital circuits around the threshold voltage.**

Index Terms— **Circuit simulation ,microwind and Dsch tool,near threshold CMOS,power dissipation.**

I. INTRODUCTION

In recently power dissipation is avoidable function in all the digital systems because power dissipation effects are performance,reliability,packaging,cost,portability.A simple transregional compact model for analyzing digital CMOS circuits around the threshold voltage.Reduce the power dissipation by means short channel effects.[1]subthreshold operation is emerging as an energy saving approach,here processor speed is less.[2]this explores the barrier to the adoption of near threshold computing(NTC)and describe current work aimed at over coming these obstacles.the three barrier addressed were 1)performance loss 2)increased variation3)increased functional failiure.[3] improving power efficiency in light of performance and area constraints are identified .In the worst case ,solution such that high voltage power delivery with on chip conversation can mitigate future problem.[4]It determined the minimum energy operating point of digital CMOS circuits with precise gurantees on reliabity and parametric yield.correlation effects should be included in the statistical analysis.[5]MOS device is necessary to reduce the supply voltage to near the device threshold voltage.it is either too complex and accuracy degrade.

II. EXISTING WORK

Analytical models for MOS devices are either too complex,they are inaccurate and discontinuous around the region of interest.

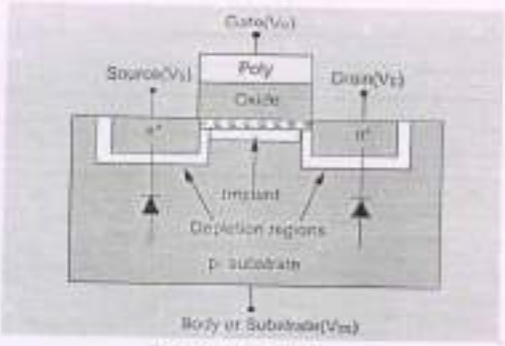

Fig.1 Nmos operation

The n-type metal-oxide-semiconductor field effect transistor (MOSFET)consists of a source and drain,two highly conducting n-type semiconductor region which are isolated fom the p-type substrate by reverse-biased p-n diodes.A metal(or poly-crystalline)gate covers the region between source and drain ,but is separated from the semiconductor by the gate oxide.

III. CMOS LAYOUT DESIGN

CMOS stands for*Complementary Metal Oxide Semiconductor*.There are N-type and P-type transistors is called complementry. N-type transistors use electrons as the current carriers. P-type transistors use holes as the current carriers. Electrons are free carriers in the conduction band with energy of Ec or just above the conduction band edge. Free electrons are generated by doping the silicon with an N-type impurity such as phosphorous or arsenic. A hole is a current carrier due to the absence of an electron in a covalent bond state, i.e. a missing electron which would otherwise be part of a silicon-to-silicon bond. Holes are free carriers in the valence band with energy of Ev or just below the valence band edge. Holes are generated by doping the silicon with a P-type impurity such as boron.metal: the gate of the transistor was made of aluminum metal in the early days, but is made of polysilicon today (for the past 25 years or more). silicon

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Data Mining Approach for Anomaly Detection in Social Network Analysis

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Abstract: Nowadays, users are more addicted to the Online Social Networks (OSN's), a network in which many users, group of people, or a particular organization are Connected via network. Use of online Social Networks has exploded and thus, causing a need of studying and understanding user behavior. Several approaches have studied the identification of anomaly detection In this paper, We propose an efficient method for anomaly detection from social networks. The present study aims at detecting the abnormal activities exhibiting different behaviors in social media application using Behavior-based anomaly detection approach. Anomalous users are detected based on their behavioral dissimilarity from others. A rich feature set is proposed for outlier detection. A method for providing visual explanation for the results is also proposed. This analysis is carried out using Facebook dataset.

Keywords Online Social Network, Data Mining, Anomaly Detection, user's social behavior,

I. INTRODUCTION

With the advancements of technology there comes a great need of studying user behavior in social networks. With an increase in the use and benefits of OSNs comes an increase in various challenges. One of the major challenges facing such networks today is the anomaly detection. The user can be detected by analyzing the user's behavior. Various techniques are used to determine the user's behavior. The existing system includes the profile analysis method of differentiating behavior on the basis of keep tracking user's introversive behavior and extroversive behavior Online Social Network(OSN) provides sharing of one's views, ideas with others, uploading their photos, sending message in order to build connections, also can be able to see the other user's latest updates who are in connections. The existing approaches includes the method that analyzes the user online behavior by profiling user's social behavior so that the hacker can be easily differentiated from the original one. Profiling user's social behavior includes the analysis of user's updates, type of messages send by the user, click streams done by the user, types of photos uploads in the account, posts made in the account, comment made by the user on others post, etc. Our paper proposes a solution to predict the abnormal behavior of the user whose behavior diverges from the normal user. An anomaly is a set of activities that deviate from the normal behavior of the user. Anomalies are also called as outliers, abnormities. Anomaly detection is the processing technique for removing anomalous data from the dataset. Therefore, in this paper technique to analyze and detect the anomalous behavior is covered. The paper is organized into various sections. In section II data mining topic is discussed. In section III related works are discussed. In section IV data mining approaches to anomaly detection are discussed. Section V will discuss the anomaly detection techniques available. Section VI presents the risk assessment based on user behavior. Section VII risky behaviors in online social networks are discussed. Section VIII tells how the system is implemented. Section IX Clustering approaches is discussed. Section X conclusion for the paper is discussed.

II. DATA MINING

Data mining is the process of discovering the patterns, associations, changes, anomalies from large amounts of data stored in datasets. The discovery process consists of an iterative sequence of the following steps:

Data cleaning – This handles noisy, erroneous, missing or irrelevant data from the collection.

Data integration – In this stage multiple, heterogeneous are combined in a common source.

Data selection – The data relevant to the analysis task are retrieved from the dataset.

Data transformation – Where the data are transformed are consolidated into forms appropriate for mining by performing aggregations operations.

Data mining – It is a crucial step, where intelligent methods are applied to extract data patterns.

Pattern evaluation – In this step, interesting patterns representing knowledge are identified based on given measures.

Knowledge representation – It is a final phase, where visualization and knowledge representation techniques are used to present the mined knowledge to the user.

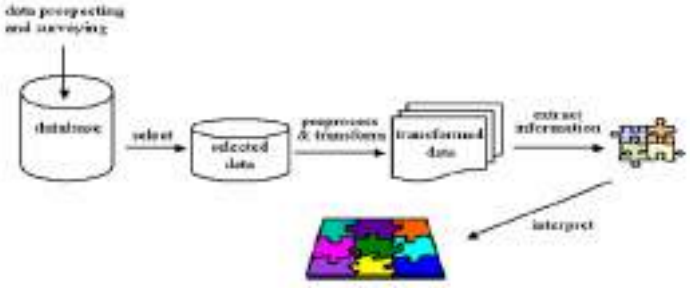

Fig II: Data mining process

III. RELATED WORK

Anomaly detection is a mature area of research. It has been successfully applied to various areas like network intrusion detection, credit-card fraud detection, email based network analysis etc. Anomaly detection algorithms work on the premise that normal behavior is more pre-dominant than abnormal behavior and will be exhibited by majority of the network entities. Chandola et al. [3] presents a comprehensive review of this. Wasserman and Faust [4] proposed theuse of centrality based measures for social network analysis. Lin and Chalupsky [5] had proposed the use of indirect connections to detect anomalous subscribers from mail data records. Chalupsky [6] used it to solve the VAST 2008 challenge [8]. While previous research work mostly views it as a classification task, we treat it as an anomaly detection problem. The false rumors are viewed as anomalies and we perform factor analysis of mixed data on our proposed features to detect these anomalies. Two strategies based on Euclidean distance and cosine similarity are proposed to describe the deviation degree. A rank based on deviation degree is computed which can facilitate further rumor detection. We show our method can achieve good performance and can shed light on automatic detection of false rumors on online social networks.

IV. DATA MINING APPROACHES TO ANOMALY DETECTION

Anomaly detection is defined as "an observation that deviates so much from the other observation". From data mining perspectives, anomaly detection is classified into the following categories:

- Supervised method
- Semi-supervised method
- Unsupervised method

A) SUPERVISED METHOD

It involves studying anomaly detection as a classification problem with the pre-labeled data, labeled either as normal or as anomalous. These methods model both the normal and abnormal behaviors. There are two applicable approaches for it.

- One, experts may pre-label the normal data and any such data which is not analogous to this model is considered anomalous.
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The other way is to do the opposite i.e. have the predefined set of anomalous data and any objects not corresponding to the set of anomalous data are considered as normal

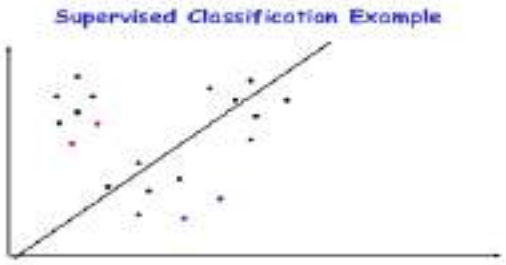


Fig IV: A(1) Supervised method

B) SEMI-SUPERVISED METHOD

Semi-supervised method, where the model is trained using the normal data, only to build the profile of normal activity. Semi-supervised methods work with two sets of data, labeled and unlabeled. So, these methods are used when out of the complete data set only few instances of data labeled as normal are available. Using the small amount of labeled data a classifier can be constructed which then tries to label the unlabeled data. Hence, a model for normal data objects is built which is used to detect the anomalies in a way that the objects not fitting the normal model are classified as anomalies. This is the simplest approach called self-training used under semi-supervised model.

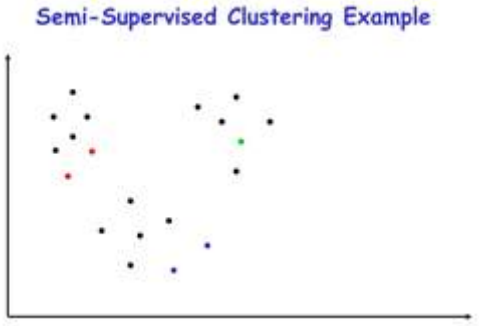


Fig IV: B(1) Semi-supervised method

C) UNSUPERVISED METHOD

Unsupervised methods, where the anomaly detection model is trained using unlabeled data that consists of both normal as well as abnormal data. Unsupervised anomaly detection methods are used when labeled data objects are not available i.e. no predefined labels as "anomalies" or "normal" are attached to the data objects. Unsupervised methods are usually studied as a clustering problem. Finding the group of objects such that the objects in the group will be similar to one another and different from the objects in other group. Two major challenges faced by unsupervised methods are as follows:

- First, a data object not belonging to any cluster is considered as anomalous but many times this deliberation can be false because, such a data object can be a noise rather than an anomaly.
- Secondly, what is usually practiced is to firstly find the clusters and then the anomalies. But this methodology seems to be quite expensive as number of anomalies present in a data set is pretty less than normal data objects.

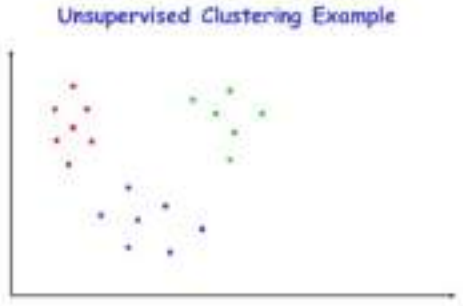


Fig IV: C(1) Unsupervised method

V. ANOMALY DETECTION TECHNIQUES

In social networks, the node disobeying these similarity measures by following behavior which is deviates from the other nodes are detect as anomalous. Anomaly detection techniques in social networks can be categorized as follows:

- Behavior based techniques
- Structural (graph) based techniques
- Spectral based techniques

A) BEHAVIOR BASED TECHNIQUES

Behavior based techniques handle the behavioral properties of the users such as number and content of message, content of the items shared, number of likes or comments on a post and duration of a conversation., shared, number of likes or comments on a post and duration of a conversation.

B) STRUCTURAL BASED TECHNIQUES

Structural based methods work on the basic principle of using structural properties to check the characteristics of normal and anomalous users. A particular graph metric is figured out for different nodes and structure and the nodes showing different values than other users are considered as anomalous. Just like supervised approach, here also a predefined normal pattern is already known and any deviation from that known pattern depicts the anomalous behavior. These techniques help to identify dynamic unlabeled anomalies by predicting future events and analyzing previous network behavior which is a precondition for dynamic anomalies.

C) SPECTRAL BASED TECHNIQUES

Spectral anomaly detection techniques help in detecting anomalies using some spectral characteristic in the spectral space of the graph.

VI. RISK ASSESSMENT BASED ON USER BEHAVIOR

Our main goal is to associate a risk score with the user based how he/she behaves in online social networks. The key idea is that the more the user behavior diverges from what is considered to be a normal behavior, more it should considered being risky. Therefore we first define a user behavioral profile.

In an online social network variety of activity are possible, such as post, comment, share, like and different types of interaction. In designing this behavioral profile, there is no need for monitoring all the users' activities. But only those that might reveal risky behavior is monitored. For example, writing more comments/posts without receiving any likes on them. Can we consider as a warning and they might be victim of an attack. On the contrary, having huge number of friends, posts, comments, likes in a short period is also consider as risky. The online social network population is heterogeneous in observed behavior, so it is not possible to define unique standard behavioral model that fits all online social network user behaviors.

However, we expect similar people tend to follow similar rules which results in similar behavioral model. For this reason, we propose risk assessment organized into two phases: The first phase aims at identifying the groups in online social network. This is achieved by clustering techniques. The second phase aims at creating behavioral model for each group identified by first phase.

VII. RISKY BEHAVIORS IN ONLINE SOCIAL NETWORKS

Due to the popularity of social network sites, cyber criminals or attackers started to exploit them in propagating malwares and carry out scams. The discrepancy is defined in terms of frequency, number, as well as type of activities.

In general, attackers use online social network infrastructure to collect and expose personal information about a user and their friends by making the user to click on some specific malicious links so as to propagate them in the network. In the following, we illustrate the most notable types of attacks:

Sybil attack: Sybil attack is one of the practical attacks in online social networks. As an example there are more than thousand social bots has been detected on Facebook. To launch this attack, a malicious user has to create multiple fake identities known as Sybil's, with the purpose to legitimate his/her identity. After that, the attackers initiate their work by sending friend requests to users in the community. Once the request has been accepted, the social bot can gather the user's private data.

Identity clone attack: In this attack, malicious user creates similar or identical profiles. The key goal is to obtain personal information about the victim's friend after successfully forging the victim and established an increased level of trust with the victim's social circle. Afterwards, he/she sends friend requests to the victim's contacts. Once the friend requests have been accepted, he builds the victim's friend network and gains access to the profiles of the victim's friends.

Socware attacks: In this attack, an adversary creates malware items, called socware, in the form of applications, pages or events containing malicious link to be propagated in the online social networks. This attack lures victims by offering false rewards to who will install/accept the socware. Once users have installed the socware, it is not only gets access to the user's personal information but also gains ability to post them on the victim's wall. As a consequence the users unknowingly end up sending socware messages or post to their friends, essentially assisting the socware's viral spread.

VIII. METHODOLOGY

Our Methodology flows through the concepts of the collection of the dataset, removing the null values, categorizing the data, clustering, risk analysis.

1. A dataset is a collection of data corresponds to the content of single database table.
2. From the dataset remove the null values.
3. Risk assessment approach is based on the idea of estimating the user's risk on the basis of how much his\her behavior deviates from the normal user. Risk assessment is composed of two phase clustering :
    a. The first phase consists of organizing the users according to group identification features.
    b. In the second phase, users are categorized using behavioral features using K-means and Expectation Maximization algorithm.

4. The risk score is estimated using Membership probability based on a value of group identification features.
    a. High membership probability-normal user.
    b. Low membership probability-abnormal user.

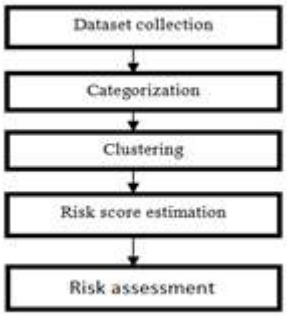
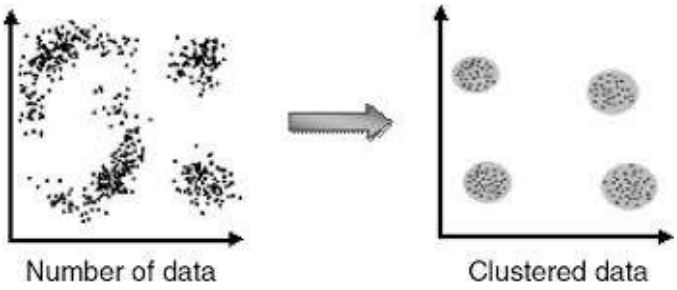


Fig VIII: Methodology

IX. CLUSTERING

Clustering is a task of partitioning a set of data based on their characteristics into clusters.It is used for pattern recognition; image processing and data analysis. It discovers structures and patterns in high dimensional data.



A) K-Means Clustering Algorithm

- K-Means is one of the simplest unsupervised learning algorithm to cluster n objects based on attributes into k partitions where k>n.
- The goal is to find groups in data, with the number of groups represented by variable K.

Step1 - **Initialization:** Randomly choose k vectors from the dataset and make them initial cluster centers.
Step2 - **Assignment:** Assign each vector to its closest center.
Step3 - **Updating:** Replace each center with a mean of its members.
Step4 - **Iteration:** Repeat step 2 and 3, until there is no more updating.

B) **Anomaly detection**
The anomaly detection algorithm proposed in this paper is based on the principle of outlier detection. An outlier in a dataset is defined as an observation which deviates so much from other observations so as to arouse suspicions that it was generated by a different mechanism.

In most real scenarios outliers are outnumbered heavily by the more commonly occurring observations. Unsupervised approaches to identify outliers are useful in detecting anomalies or nonconforming entities from large datasets. In this paper, an outlier is defined as follows [7]: Definition: Outliers of a set are the top n data elements that are farthest from their kth nearest neighbours.

IX.B (1) BOX PLOT

It is method of representing statistical data on a plot in rectangle for depicting groups of numerical data through their quartiles and vertical line inside to indicate the median value.

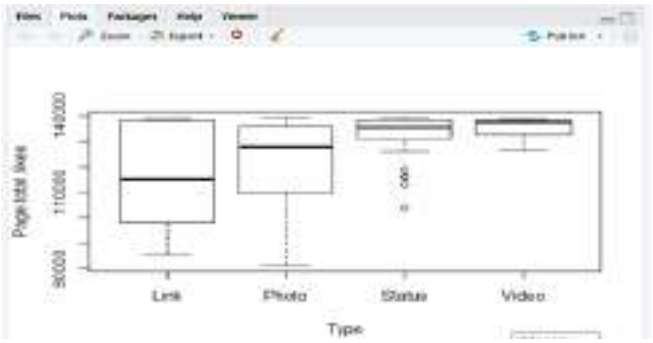


Fig IX: A(1) Box plot

IX.B (2) OUTLIERS

It is an observation point that is distant from other observations. It may indicate experimental error or variability in the measurement. It can cause problem in statistical analysis.

Outliers are extreme values that deviate from other observations on data , they may indicate a variability in a measurement, experimental errors or a novelty. In other words, an outlier is an observation that diverges from an overall pattern on a sample.

IX.B (3) HISTOGRAM

A histogram is a type of graph that is widely used in mathematics, especially in statistics. The histogram represents the frequency of occurrence of specific phenomena which lie within a specific range of values, which are arranged in consecutive and fixed intervals. The frequency of the data occurrence is represented by a bar It is an accurate representation of distribution of numerical data. It is an estimate of the probability distribution of a continuous variable.

X EXPERIMENTAL RESULTS

The proposed approach has been tested on considering the total interaction column in the face book dataset using R programming. The Maximum and minimum deviations of Total interaction column has been identified by Histogram. Then minimally deviated values are removed as outliers using Box plot. The Box plot graph should be validated in such a way that all the outliers are removed .Now ,the Histogram has been drawn for the current data will distributed in the bars eventually.

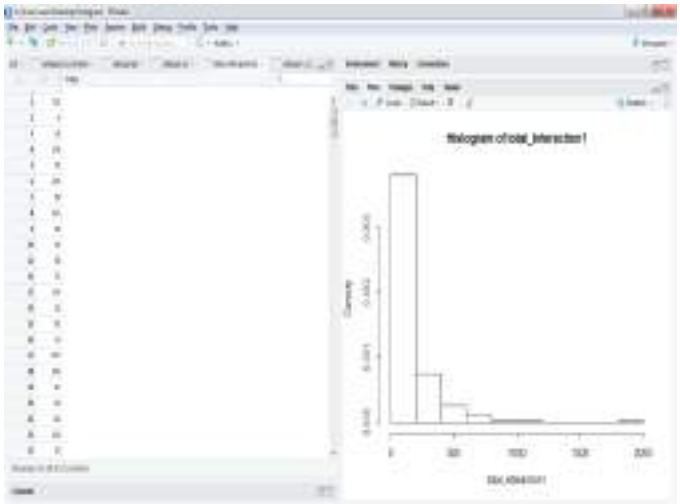


Fig : X(1) Histogram for Total interaction column

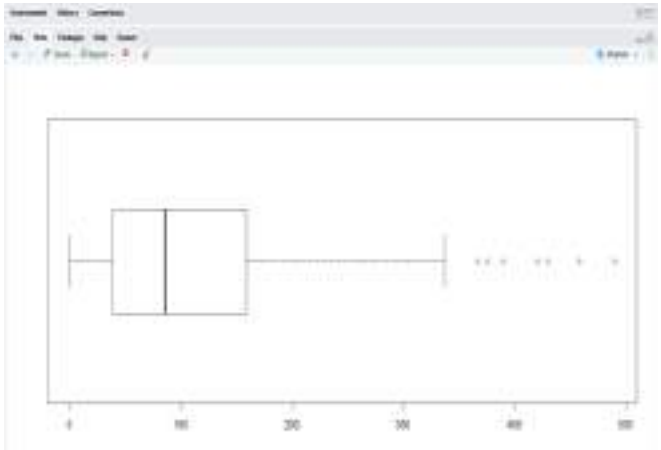


Fig : X(2) Box plot to identify the outliers

Fig : X(3) Histogram for the same Total interaction column with removed outliers

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XI. CONCLUSION

In this paper, we proposed the method to detect the anomalous users based on their behavioral dissimilarity from others by using the outlier detection. A method for providing visual explanation for the results is also proposed. This analysis is carried out using Facebook dataset assign risk score to each OSN user. This assessment is based on user behavior under idea more user behavior diverge, it is considered to be risky. This analysis is carried out in Facebook dataset for effectiveness of our estimation

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