EFFECT OF STEEL RATIO AND MINERAL ADMIXTURES ON SHORT COLUMN

A Thesis Submitted
in Partial Fulfillment of the Requirements
for the Degree of

MASTER OF TECHNOLOGY

In

Structural Engineering

By

Kartikay Krishna
(University roll No. 1170444005)

Under the Guidance of

Mr. Mohammad Afaque Khan
(Assistant Professor)

BABU BANARASI DAS UNIVERSITY
LUCKNOW

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CERTIFICATE

This is to certify that the thesis entitled titled **"Effect of Steel Ratio and Mineral Admixtures on Short Column"** by **Kartikay Krishna** Under the guidance of Assistant Professor **Mr. Mohammad Afaque Khan** to the Babu Banarasi Das University, Lucknow for the award of the degree of Master of Technology (Structural Engineering) is a bonafide record of research work carried out by him under my supervision. The contents of this thesis, in full or in parts, have not been submitted to any other Institute or University for the award of any degree or diploma.

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DECLARATION

I hereby declare that, I am the sole author of this thesis. This thesis contains no material that has been submitted previously, in whole or in part, for the award of any other academic degree or diploma. Except where otherwise indicated, this thesis is my own work.

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ACKNOWLEDGEMENT

I would like to express my special appreciation and thanks to my researcher guide Assistant Professor **Mr. Mohammad Afaque Khan.**, you have been a tremendous mentor for me. I would like to thank you for encouraging my research. Your advice on both research as well as on my career have been valuable. I would also like to thank my all faculty member of the Civil Engineering of BABU BANARASI DAS UNIVERSITY, Lucknow **Ms. Neeti Mishra, Mr. Faheem Ahmed Khan**, **Mr. Bilal Siddiqui**, **Mr Shubhranshu Jaiswal** and also to the head of department (HOD) **Mr. Anupam Mehrotra**. I also want to thank you for letting my defense be an enjoyable moment, and for your brilliant comments and suggestions, thanks to all faculty member. A special thanks to my family member and also to my all friends. Words cannot express how grateful I am to my all faculty member of BBDU, Lucknow. Thank you for supporting me for everything, and especially I can't thank all of you enough for encouraging me throughout this experience. Finally I thank my God, my best Father, for letting me through all the difficulties.

ABSTRACT

An experimental study is carried out to investigate the effect of type of lateral reinforcement as a confining material and also the effect of mineral admixtures on compressive strength of concrete in the column composite. For this, the work is carried out in two phases. In the first phase, Short columns were casted by varying volumetric ratio and spacing of lateral reinforcement. The effect of spacing, volumetric ratio on ultimate load carrying capacity of short columns is studied. And In the second phase, Short columns mineral admixtures like RHA are developed. All columns were tested in the Universal Testing Machine of 2000 KN capacity. The effect of these admixtures on ultimate load capacity of short columns is studied. Also, modes of failures, crack pattern, stress-strain patterns are also studied in both stages. The test results indicate that with increase in volumetric ratio of steel, the strength and ductility of column increases and the columns in which 10% RHA is replaced shows high strength. From the modes of failure it is observed that the short columns shows brittle fracture and zone of rupture is observed at top and bottom ends of the columns and this zone of rupture is a decrease with the decrease in spacing of ties. The spacing of ties is strongly influencing zone of rupture in all type of columns is observed in this study.

Keywords: Short Column, Volumetric Ratio, Fly Ash, RHA, Load carrying capacity.

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CHAPTER 1

INTRODUCTION

1.1 GENERAL

Column is the most authoritative structural element because it carries the entire load of the structure. The failure of the column leads to the total collapse of the whole frame structure as it transmits the vertical loads that load from the roof slab and beam, including self -weight to the foundation. Now-a-days R.C.C. columns are widely used. To achieve overall stability of structures, inelastic deformability of reinforced concrete columns is essential and it is achieved only through proper confinement of the concrete. At the same time, concrete is being used for various constructional purposes to make it suitable for different conditions. In these conditions, ordinary concrete may fail to exhibit the required strength and durability. For this, Admixtures are added in concrete to improve the quality of concrete.Mineral admixtures like fly ash, silica fume, ground granulated blast furnace slag, Metakaolin and rice husk ash which possess certain characteristics through which they influence the properties of concrete differently .The boon to construction, because it has varied direct and indirect blessings concrete has several inherent blessings such as:

High resistance and weathering action, Accessibility of ingredients at affordable value, High compressive strength, Mould ability to any form resulting in branch of knowledge finishes, Aesthetic look so it wide utilized in construction it's some disadvantages there, Low lastingness, Poor malleability, A lot of crispness, High W/C quantitative relation.

1.2 STRENGTHENING OF COLUMN

Increases the strength of column using different types of admixtures in column like silica fume, rice husk ash, ground granular blast furnaces slag etc in this type of admixtures used in concrete column using the admixtures in percentages. In this project using rice husk ash. Rice husk ash is given good strength in using concrete column. It helps in reducing the pollution in environment and also check the strength of reinforcing column in this thesis as per IS Code 456-2000 were design the column and change volumematric spacing in concrete column and casting the column according to IS: 456-2000.Change the spacing between lateral reinforcing spacing were change in according to IS: 456-2000 and check the strength of column and also compare with using admixtures in column.

1.3 Rice Husk Ash

Rice husk can be burnt into ash that fulfils the physical characteristics and chemical composition of mineral admixtures. Pozzolanic activity of rice husk ash (RHA) depends on (i) silica content, (ii) silica crystallization phase, and (iii) size and surface area of ash particles. In addition, ash must contain only a small amount of carbon.RHA that has amorphous silica content and large surface area can be produced by combustion of rice husk at controlled temperature. Suitable incinerator/furnace as well as grinding method is required for burning and grinding rice husk in order to obtain good quality ash. The optimized RHA, by controlled burn and/or grinding, has been used as a Pozzolanic material in cement and concrete. Using it provides several advantages, such as improved strength and durability properties, and environmental benefits related to the disposal of waste materials and to reduced carbon dioxide emissions. The rice paddy milling industries give the by-product rice husk. Due to the increasing rate of environmental pollution and the consideration of sustainability factor have made the idea of utilizing rice husk. About 100 million tons of rice paddy manufacture by-products are obtained around the world.

1.4 Properties of rice husk ash

Rice Husk Ash is a Pozzolanic material. It is having different physical properties. The product obtained from R.H.A. is identified by trade name Silpoz which is much finer than cement.

Physical Properties of R.H.A.

Table 1.1: Physical Properties of R.H.A

Sr. No.	Particulars	Properties
1	Color	Grey
2	Shape texture	Irregular
3	Mineralogy	Non Crystalline
4	Practical size	<45 micron
5	Odour	Odourless
6	Appearance	Very fine

1.5 ADVANTAGE OF RICE HUSK ASH

- Improve compressive strength, flexural strength and spilt tensile strength.
- RHA (Rice husk ash) mixed concrete shows better bond strength as compared to OPC concrete.
- Permeability of concrete decreases chloride diffusion and chloride permeation reduced (30%) replacement.
- RHA (Rice husk ash) makes a role to increased resistance to chemical.

1.6 DISADVANTAGE OF RICE HUSK ASH

- Suitable incinerator/furnace as well as grinding method is required for burning and grinding rice husk in order to obtain good quality ash.
- Strength of concrete is reduced larger (beyond 30%) replacement.

- There is little transportation problem.
- Unburn RHA (Rice husk ash) is not suitable for concrete production.

1.7 APPLICATIONS OF RICE HUSK ASH

The rice husk ash is a green supplementary material that has applications in small to large scale. It can be used for waterproofing. It is also used as the admixture to make the concrete resistant against chemical penetration.

The main applications of rice husk ash in the construction are:

- High-performance Concrete
- Insulator
- Green concrete
- Bathroom floors
- Industrial factory floorings
- Concreting the foundation
- Swimming pools
- Waterproofing and rehabilitation

1.8 COLUMN

A column is defined as a vertical compression member which is mainly subjected to axial loads and the effective length of which exceeds three times its least lateral dimension. Column is an important element of every reinforced concrete structure. These are used to transfer the load of superstructure to the foundation safely. Mainly columns, struts and pedestals are used as compression members in buildings, bridges, supporting system of tanks, factories and many more such structures.

1.8.1 SLENDERNESS RATIO-

The slenderness ratio of a compression member is defined as the ratio of effective length to the least lateral dimension. The columns are classified as following two types depending upon the slenderness ratio.

(i) **Short Columns:** when the slenderness ratio of column i.e. ratio of effective length to its least lateral dimension l_{ef}/b is less than or equal to 12.

(ii) **Long Columns:** If the slenderness ratio of the column is greater than 12, it is called as long or slender column.

1.9 TYPE OF REINFORCEMENT

Two type of reinforcement in R.C.C. column are-

(i) Longitudinal reinforcement.

(ii) Transverse reinforcement.

1.9.1 LONGITUDINAL REINFORCEMENT

The longitudinal reinforcement consists of steel bars placed longitudinally in a column. It is also called as main steel. The functions of longitudinal reinforcement are as follows-

(a) The cross-sectional area of longitudinal reinforcement in a column should not be less than 0.8 percent and not more than 6 percent of the gross cross-sectional area of the column.

(b) The minimum number of longitudinal bars in a column shall be 4 in square, Rectangular column and 6 in circular column.

(c) The bars shall not be less than 12 mm in diameter.

(d) A reinforced concrete column having helical reinforcement shall have at least six longitudinal bars within the helical reinforcement.

(e) In a helically reinforced column, the longitudinal bars shall be in contact with the helical reinforcement and equidistant around its inner circumference.

(f) Spacing of longitudinal bars measured along the periphery of the column shall not exceed 300 mm.

(g) In any column that has a larger cross-sectional area than that required to support the load the percentage of steel shall be based upon the area of concrete required to resist the direct stress and not upon the actual area of the column.

(h) In case of pedestals, in which the steel reinforcement is not taken into account in strength consideration, nominal reinforcement, not less than 0.15% of the gross cross-sectional area, shall be provided.

(i) To share the compressive loads along with concrete, thus reducing the overall size of the column and leaving more usable area.

(j) To resist tensile stresses developed due to any moment or accidental eccentricity.

(k) To impart ductility to the column.

(l) To reduce the effect of creep and shrinkage due to continuous constant loading applied for a long time.

1.9.2 TRANSVERSE REINFORCEMENT

The transverse reinforcement is provided along the lateral direction of the column in the form of the ties or spirals enclosing the main steel. The function of transverse steel is as following-

(a) **Diameter of lateral ties :** The diameter of the lateral ties (links) should be greater than

(i) ¼ th of the diameter of the largest longitudinal bar.

(ii) 6 mm.

(b) **Pitch of lateral ties:** The pitch or spacing of the lateral ties (links) should not be greater than the following:

(i) Least lateral dimension of the column.

(ii) 16times the diameter of the smallest longitudinal bar.

(iii) 300 mm.

(c) To hold the longitudinal bars in position.

(d) To prevent buckling of the main longitudinal bars.

(e) To resist diagonal tension caused due to transverse shear developed because of any moment or load.

(f) To impart ductility to the column.

(g) To prevent longitudinal splitting or bulging out of concrete by confining it in the core.

1.10 COVER

The nominal cover for a longitudinal reinforcing bar in a column shall not be less than any of the following:

(a) 40 mm

(b) The diameter of the bar.

In the case of small sized columns of minimum dimensions of 200 mm or under whose reinforcing bar do not exceed 12 mm, a nominal cover of 25 mm be used.

1.11 CLASSIFICATION OF COLUMN

- Shapes of cross-section.
- Material of construction.
- Type of loading.

1.11.1 SHAPES OF CROSS SECTION

(i) Square (ii) Hexagonal

(iii) Rectangular (v) Octagonal

(iv) Circular (vi) T-shape or L-shape etc.

1.11.2 MATERIAL OF CONSTRUCTION

(i) Timber Columns.

(ii) Masonry Columns.

(iii) Steel columns.

(iv) Composite columns.

(v) **R.C.C. Columns :** Steel Columns are used for mostly all types of buildings and other R.C.C. structures like tanks, bridges etc.

1.11.3 TYPES OF COLUMN

A column may be classified as follows, based on type of loading:

(i) Axially loaded columns.

(ii) Eccentrically loaded columns.

(i) **Axially loaded column:** The columns which are subjected to loads acting along the longitudinal axis or centroid of the column section are called as axially loaded columns.

(ii) **Eccentrically loaded columns:** Eccentrically loaded columns are those columns in which the loads do not act on the longitudinal axis of the column. They are subjected to direct compressive stress and bending stresses both. Eccentrically loaded columns may be subjected to uniaxial bending.

1.12 OBJECT OF WORK

The objectives of this work are:

- To study the load carrying capacity of columns which are confined with different types of lateral reinforcements and with different types of admixtures .
- To study the effect of volumetric ratio on short columns.

CHAPTER 2

LITERATURE REVIEW

2.1 INRODUCTION

To minimize the cost of construction of concrete structures, researchers are trying to find alternatives of the ingredients of concrete without compromising its strength. Cement is the primary raw material of concrete mix, and manufacturing of cement caused severe environmental pollution, for example, it leads to CO_2 emissions. The major cost of concrete can be optimized by the use of various types of supplementary materials as partial replacement of cement content. Rice husk is produced in millions of tons per year as a byproduct material from agricultural and industrial processes. After full combustion of rice husk, it produced 20–25% RHA by weight.RHA contains non-crystalline silica and it could be a suitable partly replacement for Portland cement. Rice husk ash (RHA) is considered as a highly Pozzolanic material which can be used as partial replacements of cement in concrete. Usage of RHA in concrete as partly replacements of cement minimizes the cost of concrete construction and helps to easy recycling of waste generated from incinerations or combustions of rice husk used in agricultural and industrial projects and also helps to reduce the CO_2 pollution from cement production process. RHA has been successfully used as a Pozzolana in commercial production in a number of countries including Columbia, Thailand and India. Researchers are investigating the mechanical and structural properties of RHA to use in concrete with and without additional materials. The construction industry has seen an increasing demand to reinstate, rejuvenate, strengthen and upgrade existing concrete structures. This may due to the environment degradation, design inadequacies, poor construction practices, irregular maintenance, requirement of revision of codes in practice, increase in the loads and seismic conditions etc. The most practical solution for rehabilitation can be that which minimize the damage due to structural collapse and these type of rehabilitation can be done by strengthening a selected critical structural component. Thus this retrofitting and strengthening of existing structure has become one of the most important challenges in civil engineering. In many cases, the complete replacement of an existing structure is not a cost-effective solution and it is likely to become an increased financial burden. In such situation retrofitting or repair of the critical component is the most economical way of strengthening the structure. In India it has been observed that mostly compression members of the building have been failed during earthquake due to poor lateral confinement. During high intensity earthquake, the structures are likely to undergo inelastic deformation and to depend on ductility. The material can be used as an efficient and economic solution for external confinement of concrete members.

2.2 NEED FOR INVESTIGATION

To improve the strength and durability of ordinary concrete columns, lots of researchers have been looking for different strengthening materials.RHA (Rice husk ash) is using in concrete and increases the strength of concrete. This material is not expansive and easily available in India. It is likely green product material and easily available in India. Improve the strength of concrete and also investigated to short column in reinforcement provided in column and what is the effect of in column. Investigation time many research using different type of material used in column and improved strength of column and resist the earthquake. Then compare the load carrying capacity of column as per IS Code design the column and lateral reinforcement provided in column and change the spacing of confinement as per IS code:456-2000 and also using in RHA(rice husk ash) were used in column and check the load carrying capacity on UTM. This is economically design column and not expansive.

2.3 SCOPE OF INVESTIGATION

An experimental study is carried out to investigate the effect of type of lateral reinforcement as a confining material and also the effect of mineral admixtures on compressive strength of concrete in the column composite. The work is carried out in two phases. In the first phase, Short columns were casted by varying volumetric ratio and spacing of lateral reinforcement. The effect of spacing, volumetric ratio on ultimate load carrying capacity of short columns is studied. And in the second phase, Short columns with different types of mineral admixtures are developed. All the columns were tested in the Universal Testing Machine of 2000 KN capacity. The effect of these admixtures on ultimate load capacity of short columns is studied. Also, modes of failures, stress-strain patterns are also studies in both stages. This tested is basically check strength of column added with minerals admixtures and also the check of confinement change spacing as per IS code: 456-2000 design column. This is basically for tested column and increases strength with chief cost. In India, rice husk is easily available and bulk amount in present in India. This is good for former because today India main problem former is given good cost in selling of food and waste material are bulk amount in present on former. This is good news for former waste materials using in concrete and structural building improvement strength.

2.4 Literature Survey

Shubham R. Dakhane (2016)[1]: In this research paper, the thorough analysis of the construction material used in the preparation of Ferro cement and concluded that houses in Ferro cement can easily sustain in earthquake up to scale 7.5-8.Even this technique can be used for retrofitting of water structures and the use of Ferro cement layers will substitute as shear reinforcement in the joint region. Further, Ferro cement construction is an exciting alternative to the conventional wooden and masonry methods.

Mohamed A. Tarkhan (2015)[2]: In this experimental study, it was investigated that under concentric loading conditions, RC columns can be strengthened significantly with enhanced strength and performance using Ferro cement jacket. After strengthening, all test columns showed higher deformation at ultimate load, increase in ductility ratio, and considerable increase in energy absorption as well. Moreover, high pre-loading levels resulted in lower gain in the load carrying capacity and energy absorption, yet increase in gain in the ductility ratio. Columns pre-loaded to 50% of the ultimate load of control column showed higher gain in the ultimate load and energy absorption than those pre-loaded to 75% however the increase in the ductility ratio was the least.

R. Hafiza (2015)[3]: This paper investigates the column specimens for the ultimate load capacity and stressed samples confined with Ferro cement using welded wire mesh as the confining material. In case of pre-stressed specimens, the results showed that the Ferro cement confinement increased the load carrying capacity to 33%.In case of stressed samples to a value of 60% and 80% of the ultimate load capacity; the confinement enhanced the ultimate load capacity to 28% and 15% respectively. With the confinement the column specimens failed in a ductile manner as compared to brittle failure of the control specimens.

Sumit Bansal (2015)[4]: Replacement of cement by rice husk ash showed in M30 grade concrete compressive strength improvement up to the replacement of 10% in all ages .Both concrete mixes at 10% rice husk ash level showed 3 to 10% increase in compressive strength. Rice husk ash levels of 15 to 20% showed reduction in compressive strength in all age.

Shabans Salik K (2015)[5]: This paper evaluates the performance of short concrete compression members strong with fiber rope wrapping, below axial compression. From the study on small-scale specimens, it's been seen that the fiber rope wrapped specimen exhibit important increase in strength, as compared to regulate specimen, because of the confinement by rope wrapping. The tests were allotted with ropes of various diameters zero.6cm, 1cm and 1.4cm at spacing of zero.0h, 0.1h, 0.2h and 0.3h, wherever h is that the height of the specimen. Most improvement was obtained for wrapping with fiber rope of diameter one.4 cm at 0.0h spacing. The strength was found to be inflated with increase in diameter of rope and faded with increase in spacing. the prices for unit improvement with varied wrapping were figured out and therefore the methodology was found to be terribly cost-efficient. Because the weight of fiber rope is negligibly little, it's much no impact on footing style.

Obilade (2014)[6]: The optimum addition of RHA as partial replacement for cement is in the range 0-20%. The compacting factor values of the concrete reduced as the percentage of RHA replacement increased. The Compressive Strengths of concrete reduced as the Percentage RHA replacement increased.

Makarand Suresh Kulkarni (2014)[7]: The optimized RHA, by controlled burn and/or grinding, has been used as a Pozzolanic material in cement and concrete. Using it provides several advantages, such as improved strength and durability properties, and environmental benefits related to the disposal of waste materials and to reduced carbon dioxide emissions. Up to now, little research has been done to investigate the use of RHA as supplementary material in cement and concrete production in Vietnam. The main objective of this work is to study the suitability of the rice husk ash as a Pozzolanic material for cement replacement in concrete. However it is expected that the use of rice husk ash in concrete improve the strength properties of concrete. Also it is an attempt made to develop the concrete using rice husk ash as a source material for partial replacement of cement, which satisfies the various structural properties of concrete like compressive strength. From the entire experimental work & studies it is concluded that mix M20 (0+20%RHA) is the best combination among all mixes, which gives max, tensile, flexure & compression strength over normal concrete.

Veena M (2014)[8]: This research paper investigates the use of improved Ferro cement jacketing to strengthen the RC short square columns and concluded that ultimate load carrying capacity for advanced jacketed square columns improved by 1.45 times compared to that of control specimens whereas the improvement was only 1.30 times for conventionally jacketed specimens. The energy absorption capacity for advanced jacketed specimens was improved by 145% but for conventionally jacketed specimens, the improvement was only 95%. Moreover, Displacement ductility factor for advanced jacketed specimens improved by 102% compared to control specimens but for conventionally jacketed specimens, the improvement was only 60%.

Manu Chaudhary (2013)[9]: Due to Pozzolanic reactivity, Rice Husk Ash is used as a supplementary cementing material in concrete. It has economical and technical advantages to be used in concrete. I am going to partially replace cement by the use of RHA by 5%, 10% & 15% & 20% by weight of cement in four different experiments to find out the maximum strength and compare it with the strength of normal concrete by using the grade of M30 at the days of 7days, 14days &28 days. This research therefore is an investigation of the performance of the concrete made of partially replacing OPC with RHA on the structural integrity and properties of RHA concrete. At the initial ages, as replacement level of RHA increases the compressive strength also increases.

Md. Mozaffar Masud (2013)[10]: The present study investigates the result of confinement mistreatment Ferro cement as wrapping material on the circular RC columns below coaxial loading condition. Methods: Experimental studies were allotted on the confining result mistreatment external confinement technique with one layer and 2 layers of GI wire mesh below concentrically loaded condition. All columns were tested by uniform coaxial compressive load from prime with a hydraulic compression testing machine of capability 1000KN. Findings: Most of the researches have done on confining result of either long column or short column (slenderness quantitative relation quite 3). This paper demonstrates the confining result on short column having slenderness quantitative relation is a smaller amount than three, such a column is named pedestal. Pedestal could be a variety of short column that is employed as a base support for steel structure, sculpture or jar. To guard the column of steel structure from corrosion that's in direct contact of soil, pedestal is provided. Throughout earthquake such a structure will collapse or maybe cracks will develop. Hence, Ferro cement structures are extremely ductile and energy dissipating material which will undergoes massive deformations while not collapsing throughout earthquakes. Even the malformed structures may be strong at terribly low value when deformation. Steel jacketing has proved to be a good live for strengthening or retrofitting and has been wide utilized in follow; however the engineering community is presently searching for alternatives. Applications/Improvements: Material like Ferro cement is oldest, value effective methodology emerges an alternate answer for strengthening of ferroconcrete column. External confinement or encasing of column with Ferro cement enhances the strength and malleability of concrete column.

H. M. Mohamed (2011)[11]: Slenderness ratio effect on the behavior of steel and carbon-FRP reinforced concrete-filled FRP tubes. Concrete-filled fiber-reinforced polymer (FRP) tubes (CFFTs) system is one of the most promising techniques to protect the reinforced concrete structures from aggressive environmental conditions. This paper presents the results of an experimental investigation on the strength and failure modes of ten CFFT columns. The effect of two parameters and their interactions on the buckling behavior were investigated; namely, the type of internal reinforcement (steel or carbon FRP bars) and the slenderness ratio. The eleven CFFT columns of different slenderness ratio 4, 8, 12, 16 and 20 were tested under pure compression load. The internal diameter and the thickness of the FRP tubes are 152 mm and 2.65 mm, respectively. The test results indicated that the axial compressive strength of steel and CFRP-reinforced CFFT columns was reduced by 13% to 32% with increasing the slenderness ratio from 4 to 20. Also, it was found that the axial capacity of CFRP-reinforced CFFT columns resulted in average 12.5% reduction as compared to the counterpart steel-reinforced CFFT columns. The application of composite materials has been propagated by the deterioration of the old conventional concrete, steel, and timber structures. The fiber reinforced polymers (FRP) tubes can play an important role in replacing transverse steel by providing ductility and strength for reinforced concrete columns. The use of FRP composite tubes in civil engineering applications offers several advantages such as confinement, protecting the concrete core, providing shear or/and flexural reinforcement and finally, act as a permanent formwork which save the time and cost of the construction.

Hanaa I EI Sayad (2011)[12]: The aim of this investigation is first off to judge the various strategies used for confining the ferroconcrete (R.C) columns either internally or outwardly. Secondly, the result of warming on the performance of confining strategies is studied mistreatment the pc program “ANSYS five.4”. Beside the normal crosswise steel ties, the interior confinement was glad by steel fibers or a cage of expanded metal mesh within the ties, whereas external confinement was achieved by wrapping the studied columns with Ferro cement layers or GFRP sheets. Six R.C. columns were ready, namely, the management column strengthened historically with crosswise ties solely, 2 columns containing.

Abhilash Shukla (2011)[13]: there has been seen an increasing number of research on the use and utilization of industrial, agricultural and thermoelectric plants residue in the production of concrete. Different materials with Pozzolanic properties such as fly ash, condensed silica fume, blast furnace slag and rice husk ash have played an important part in the production of high performance concrete. During the late 20th century, there has been an increase in the consumption of mineral admixture by the cement and concrete industries. The rate is expected to increase. The increasing demand for cement and concrete is met by the partial cement replacement. Substantial energy and cost savings can result when industrial by-products are used as a partial replacement for the energy intensive Portland cement. The presence of mineral admixture and mineral admixtures in concrete is known to impart significant improvement in workability and durability. Among the different existing residues and by products, the possibility of using rice husk ash in the production of structural concrete is very important for India. India is the second largest rice paddy cultivating country in the world. Both the technical advantages offered by structural concrete containing rice husk ash and the social benefits related to the decrease in number of problems of ash disposal in the environment have simulated the development of research into the potentialities of this material.

P. Chandan kumar (2010)[14]: Rice Husk Ash as an admixture to an already replaced Cement with fly ash (Portland Pozzolana Cement) in Concrete, and an attempt has been made to investigate the strength parameters of concrete(Compressive and Flexural). For normal concrete, Indian Standard (IS) method of mix design is adopted. Five different replacement levels namely 5%, 7.5%, 10%, 12.5% and 15% are chosen for the study concerned for replacement method. A range of curing periods starting from 3 days, 7 days, 28 days and 56 days are considered in the present study. Strength and cost savings of Rice Husk Ash concrete proves it to be a better material than various other supplementary materials which involve higher transport cost. By using this Rice husk ash in concrete as replacement the emission of greenhouse gases can be decreased to a greater extent. As a result there is greater possibility to gain more number of carbon credits.

P Sangeetha (2010)[15]: Fiber – Wrapping mistreatment Fiber – strengthened Plastic (FRP) shells is one amongst effective strategies, considerably enhances the strength and malleability of concrete columns. The paper reports the behavior of the GFRP wrapped concrete columns below uniaxial compression. The cross section of the concrete columns thought-about within the work is circular with diameter of 150mm and height 300mm. The Parameters that ar varied within the investigation ar wrapping shell materials, (which includes GFRP Materials Surface Mat(SM), shredded Strand Mat (CSM) and woven Roving Mat (WRM)), variety of Plies (1Ply and 3plies) and amount of natural action (7 Days). Results from a series of the experimental study were reportable and mentioned. The study on little – scale specimens showed that confinement inflated the strength of the concrete columns loaded axially.

Shankar kumar (2010)[16]: Invention of latest strategies in strengthening concrete is below work for many years. On the track of such invention Fiber strengthened Composite materials plays a major role. The most perform of fiber reinforcement is to hold the load on its length and additionally to supply stiffness and strength in one direction. FRP therefore alters the compressive strength, lastingness and flexural strength of concrete to an honest extent and therefore it imprints as an honest answer for strengthening concrete. FRP materials may be outwardly bonded or wrapped to the present structure; therefore they will even be used for rehabilitation works. There are 3 major varieties of fiber strengthened polymers utilized in construction works. they're fiber strengthened compound (GFRP), Carbon fiber strengthened compound (CFRP) and Armed fiber strengthened compound (AFRP). Within the gift investigation the result of GFRP on M25 and M50 concrete combine is studied at 2 cases. First, result of GFRP on the compressive and flexural strength of M25 and M50 concrete combine with relevance variety of layers, and second result of GFRP on compressive strength M25 and M50 concrete combine with relevance variety of layers at 2000C temperature that is termed as sturdiness studies.

Habeeb (2009) [17]: studied the effect of RHA on shrinkage of concrete mixtures containing 20% of RHA at three different average particle sizes. They concluded that the drying shrinkage was significantly affected by RHA fineness. The addition of micro fine particles of RHA to concrete would increase the drying shrinkage. While coarser particles of RHA exhibited lower values than the plain cement based concrete. These contributions can be justified by the Pozzolanic and the filler effects.

Chindaprasirt (2008)[18]: studied the effect of RHA and fly ash on corrosion resistance of Portland cement concrete and concluded that both fly ash and RHA are very effective in improving the corrosion resistance of mortars indicating better contribution of RHA to corrosion resistance in comparison to that of fly ash.

Mahmud (1996)[19]: Inclusion of RHA as partial replacement of cement enhances the compressive strength of concrete, but the optimum replacement level of OPC by RHA to give maximum long term strength enhancement has been reported between 10% up to 30%.

CHAPTER 3

EXPERIMENTAL STUDY

3.1 CASTING OF SPECIMEN

The present work is mainly focused on studying the effect of type of lateral reinforcement as a confining material and also the effect of mineral admixtures on compressive strength of concrete in the column composite. The short columns size of height 2 feet and length and breadth of column 9X9 inch were selected. The short columns were casted and in tested on UTM (Universal testing machine). The above work is carried out in two phases and also using RHA (rice husk ash) admixtures on short column also check the strength of RHA using admixtures in short column strength on UTM (universal testing machine) and also the modes of failures are observed in two phases of work. Total 12 short column were casted and A total of six short square column specimens are casted along with PCC(Plain cement concrete) had an size of column is Height of column 2 feet and 4-12 mm diameter of main bars and 8 mm diameter lateral ties @192 mm c/c 9x9 inch were casted and tested. They included 3 square short column are Transverse Reinforcement spacing of 192 mm c/c and the remaining three column are Transverse Reinforcement spacing of 192 mm c/c . All these six columns are divided into two series. Three columns are tested for each series. The Crushing Load on Short Columns were casted and tested on UTM (Universal testing machine) and also six set of column specimens are casted along with minerals admixture had an and size of column is Height of column 2’ and 4-16mm diameter of main bars and 8mm diameter lateral ties@256 mm c/c 9”x9” were casted and tested. and each set consists of three columns. Columns are developed by replacing the cement with Rice husk ash admixtures. And the minerals admixture column specimen was also casted to compare with remaining column**.** They included 3 square short column are Transverse_Reinforcement spacing of 256 mm c/c and the remaining three column are Transverse Reinforcement spacing of 256 mm c/c . All these six columns are divided into two series. Three columns are tested for each series. The Crushing Load on Short Columns were casted and tested on UTM .All column testing on 7,14,28 days and compare with using admixtures column and also compare with in changing volumetric ratio column. Using M25 grade of concrete. A proportion of **1:1:2** is taken for cement, fine aggregate and course aggregate for casting of beams. The mixing of these materials is done by using concrete mixture. And replacing of cement with 10% RHA (rice husk ash) and casted column and testing on 7, 14, 28 days.

3.2 TESTING OF MATERIAL

All testing were performed in lab and take out the result and result were compared to standard result as per IS Code design and tasting all material. All material and specimen were testing on **'AIECRO ENGINEERS AND CONSULTANTS' TARAMANDAL, GORAKHPUR (U.P.).**

3.2.1 CEMENT

Ordinary Portland cement 43 grade (OPC) of ACC brand is used for the experiment. It is tested for its physical properties in accordance with Indian Standard Code 8112:2013.

Tests were conducted on Cement and the details are as below:

Fig 3.1 ACC CEMENT BAG

3.2.1.1 Fineness Test {IS: 4031-1 (1996)}

The fineness of cement is a measure of the size of particles of cement. The fineness of cement affects the rate of hydration and hence the rate of gain of strength and also the rate of evolution of heat also varies on varying fineness of cement. As per increase in fineness of cement there is increment in the surface area which leads to increase the rate of hydration as well as fasten the development of strength. For favorable condition maximum number of particles of cement should have a size less than about 100 microns and the smallest particle may have a size of about 1.5 microns but on an average the particle size of cement is taken as 10 microns. As per Indian Standards, the residue should not exceed 10% when the cement is sieved on IS sieve No. 9.In my practical it was 6%.

Fig 3.2 IS Sieve No.9

3.2.1.2 Setting Time IS: 4031 (Part 5) -1988

(i) Initial Setting time

There are basically two types of setting time that we have to be calculate for the cement i.e. Initial and Final setting time.

Initial setting time is defined as the time elapsed when the water is added to the cement to the time when paste starts losing its plasticity. Initial Setting Time: First of all we lower the needle slowly and bring it in contact with the surface of the paste and quickly release. Allow it to penetrate into the paste. In the beginning the needle will completely pierce through the paste but after some time. Paste starts losing its plasticity, the needle may penetrate only to a depth of 33-35 mm from the top. The period elapsing between the times when water is added to the cement and the time which the needle penetrates the test block to a depth equal to 33-35 mm from the top is known as Initial Setting Time. Initial setting time for ACC OPC-43 is 90 minutes by above method.

Fig 3.3 Testing of Initial and Final setting time with Vicat apparatus

(ii) Final Setting Time

The final setting time is the time elapsed when the water is added to the cement and the time when the paste has completely lost its plasticity and has attained sufficient firmness to resist certain definite pressure.

The cement shall be considered as finally set when the needle after lowering left an impression on the cement surface but the collar fails to do so i.e. the paste has attained such hardness that the centre needle does not pierce through the paste more than 5 mm after lowering. Final setting time for ACC OPC-43 is 310 minutes by above method.

3.2.1.3 Compressive Strength IS: 4031 (Part 6) - 1988

The compressive strength of 70.7×70.7×70.7 mm^3 cubes were measured according to **IS:2250-1981**.It is one of the important properties. The strength of the cement depends upon the cohesion of cement, adhesion to the aggregate etc. Generally, we take 1:3 of cement to sand in a non-porous tray and mix thoroughly with a trowel for one minute then add water with consistency of combined weight of cement and sand and mix the three ingredients thoroughly until the mixture is of uniform color. The time of mixing should lie between 3 to 4 minutes (not be less than 3 minutes nor more than 4 minutes). Now the cube is casting by the compaction of mortar in the mould. The three cubes are tested for compressive strength at 3days, 7 days and 28 days and the average result of compressive strength of concrete cube is 45 N/mm^2.

3.2.1.4 Specific Gravity of Cement IS-4031 PART (11):1988

The flask is allowed to dry completely and made free from liquid and moisture. The weight of the empty flask is taken as W_1 and The bottle is filled with cement to its half (Around 50gm of cement) and closed with a stopper and the arrangement is weighed with stopper and taken as W_2 and to this kerosene is added to the top of the bottle. The mixture is mixed thoroughly and air bubbles are removed. The flask with kerosene, cement with stopper is weighed and taken as W_3. Next, the flask is emptied and filled with kerosene to the top. The arrangement is weighed and taken as W_4 and then calculate the specific gravity of cement with formula-

Specific gravity of kerosene is 0.79 g/cc.

$$\text{Specific Gravity of Cement} = \frac{(w_2 - w_1)}{(w_2 - w_1) - (w_3 - w_4)} \times 0.79.$$

Specific Gravity of cement is 2.10 g/cc and compare to standard value and value is ok as per IS Code.

Fig 3.4 Le Chatelier Apparatus

3.2.2 Sand

Sand was used throughout the study as the fine aggregate conforming to grading **Zone-III** as per **IS: 383-1970.** The sand was air-dried and sieved to eliminate any foreign particles before mixing.

Fig 3.5 Sieve analysis of fine aggregate

3.2.2.1 Specific Gravity and Water Absorption of fine Aggregate IS: 2386 (Part- III) 1963

Weight 2000gms of the Zone-III sand sample and partially fill the Pycnometer with water. Immediately put into the Pycnometer saturated surface dry aggregate and then fill with additional water to approximately 90% of capacity and Roll invert the Pycnometer to eliminate all air bubbles and Adjust its temperature to 23±1.7 °C by putting the Pycnometer in a water bath for an hour and Bring the water level in the Pycnometer to its calibrated capacity and Determine the total weight of the Pycnometer, specimen and water and Remove the fine aggregate from the Pycnometer, dry to constant weight at temp. 110±5°C cool in air at room temperature for one hour, and weigh and determine the weight of the Pycnometer filled to its capacity with water at 23 °C.

A- Weight of Pycnometer with sand and water to calibration mark.

B- Weight of Pycnometer filled with water (gm).

C- Weight of the saturated surface-dry specimen.

D- Weight of oven dry specimen in air.

Calculate with formula of specific gravity of fine aggregate and also calculate of water absorption of fine aggregate.

Specific Gravity = $\frac{D}{C-(A-B)}$

Absorption = $\frac{(C-D)}{D} \times 100$

And Formula was used and calculated specific gravity of fine aggregate is 2.63 and water absorption is 0.80%.

Fig 3.6 Testing of specific gravity of fine aggregate with Pycnometer

3.2.3 COARSE

Coarse was used throughout the study as the coarse aggregate conforming to 20 mm Single sized Aggregate of Nominal Size as per IS code (383:19

3.2.3.1 Specific Gravity and water Absorption of Coarse Aggregate IS Code-2386(part III):1963-

Take the sample of coarse aggregate using the sample splitter and Sieve the sample with 4.75 mm sieves and ignore the materials passing through No .4.75 sieve and Wash the sample to remove dust and Put the sample in the oven at 105 °C. for 24 hours and Get the sample out of the oven, leave it to cool then determine its weight and Submerge the sample in water for 24 hours and Remove the sample from the water and roll it in a large absorbent cloth until all visible films of water are removed .Wipe the larger particles individually. Take care to avoid evaporation of water from aggregate pores during the operation of surface- drying and take the required weight of the sample in its (S.S.D) (Saturated Surface Dry) condition and after weighing, immediately place the S.S.D sample in the sample container and determine its weight in water at 23 ± 1 °C. Take care to remove all entrapped a before weighing by shaking the container while immersed and Dry the test sample to constant weight at a temperature of 110 ± 5 °C, Cool in air at room temperature 1 to 3 hours, or until the aggregate has cooled to a temperature that is comfortable to handle, and weigh.

A = weight of sample + vessel + water.

B = Weight of vessel + water.

C = Weight of S.S.D. sample in air.

D = Weight of oven-dry test sample in air.

Calculate with formula of specific gravity of fine aggregate and also calculate of water absorption of fine aggregate

$$\text{Specific Gravity} = \frac{D}{C-(A-B)}$$

$$\text{Absorption\%} = \frac{(C-D)}{D} \times 100$$

Formula was used and calculated specific gravity of coarse aggregate was found 2.64 and water absorption as 0.81%.

Fig 3.7 Drying of coarse aggregate in oven

3.2.4 Water

The quality of water is important because foreign material present in water can adversely affect the strength of concrete. Water used for producing and curing concrete should be reasonably clean and free from toxic substances such as oil, acid, sugar, silt, alkali, salt, organic matter and other elements which are harmful to the concrete. If the water is drinkable, it is considered to be appropriate for concrete making. Hence, potable tap water available at Geo-tech Engineering Lab was used in this study for mixing and curing.

Water to be used in the concrete work should have following properties:

- It should be free from injurious amount of soils
- It should be free from injurious amount of acids, alkalis or other organic or inorganic impurities.
- It should be free from iron, vegetable matter or any other type of substances, which are likely to have adverse effect on concrete or reinforcement.
- It should be fit for drinking purposes.
- The function of water in concrete
- It acts as lubricant
- It acts as a chemically with cement to form the binding paste for coarse aggregate and reinforcement.
- It enables the concrete mix to flow into formwork.

3.2.5 COMPRESSIVE STRENGTH OF CONCRETE M25 IS Code 516:1959.

Use M25 grade of concrete were used making of concrete cube and testing on compression testing machine with the help of determine compressive strength of concrete. Take all material of cement, sand and aggregate. Weight all materials with ratio of concrete **1:1:2** and all material were collected and all material were mixed with hand mixing of all material used with nominal mix. Firstly weight of cement and sand and aggregate and mixed with hand and used of water cement ratio is taken as per IS: 10262-2008 is 0.45. All concrete cubes were design as per IS: 516:1959 used. Nominal mixed as per IS: 10262-2008. Use making of concrete cube. All material mixed with dry and then water added as per IS: 10262-2008 and used w/c ratio. All properly mixed and no bleeding in mixture and properly mixed and put on slump cone and check the workability of concrete and then put on the mould size is standard as per IS. 15 x15 x 15 cm. all mixtures of concrete put on slump check workability and workability checking over then all material put on mould is like cube all side are equal 15 x 15x 15 cm. all mixtures fill on mould and leave the mixture in 24 hours in mould after 24 hour take out the concrete cube in mould and put in water/curing for 7, 14 and 28 days. After in these day curing were completed of concrete cube were testing on CTM (compressive testing machine) concrete cube placed on the CTM and test concrete cube and check the first crack found on surface of cube. Then stop the loading and notes the reading on which point crack were found and calculate the compressive strength with formula-

Compressive strength = pressure / surface area of concrete cube. The compressive strength of concrete on 7 days is 17.77 N/mm^2. And compressive strength of concrete on 28 days is 27.11 N/mm^2.

Procedure with same on other days and testing and same formula were used and check the compressive strength.

And today construction field want improved the strength of concrete and many research using different type of admixture were used in concrete and improved the strength in my project were used admixture RHA (rice husk ash) and many research on RHA. Many results found improved the concrete strength and check the compressive strength of concrete with admixture of RHA (rice husk ash) in and using admixture in concrete during mixing time of concrete admixture were used but partially replacement of cement in concrete. Firstly material weight coarse aggregate, sand and cement also and cement weight of 10% using RHA (rice husk ash) were used. In mixing of admixtures of concrete with normal hand mixing and same as w/c ratio as per IS: 10262-2008. Check the workability of concrete and highly bleeding of water in concrete is not good and low bleeding is good and all mixtures put on mould for 7,14 and 28 days. Check the compressive strength with help of CTM (compressive testing machine).concrete cube put on CTM and first crack found on surface is stop the loading and take result on this point crack were found and calculate the compressive strength of concrete with using 10% RHA (rice husk ash) were used in concrete as same formula were used are-

Compressive strength=pressure/surface area of concrete cube and then comes the compressive strength of concrete with added of 10% RHA on 7 days is 16.88 N/mm^2. And compressive strength of concrete with added of 10% RHA on 28 days is 27.77 N/mm^2.

Compressive strength of concrete has come with and without using 10% RHA(rice husk ash) on seeing the result on 7 days plain cement concrete is greater strength gives compare to using 10% RHA mixed concrete is compressive strength on 7 days is low strength compare to plain cement concrete and seeing on the 28 days plain cement concrete strength is decreases compared to 10% RHA (rice husk ash) mixed concrete strength slightly increase compared to plain cement concrete and improved the strength on 28 days. Result as comes and see the strength of concrete increased using admixture and RHA is economically better for concrete and improved the strength and making of short column using this admixtures were used in concrete and gives better strength .
Is like a green concrete improved better result gives and improved strength of concrete.

Fig 3.8 Curing of concrete cube

3.3 Design of short column

Make a short column height of column 2' feet and size of column 9" x 9" (according to IS: 456-2000 height of column is less than 3 meter is called short column) and 25 mm cover will be provided on short column (according to IS: 456-2000 minimum cover will be provide on short column 25 mm) Diameter of main bar 12 mm (according to IS:456-2000 minimum 12 mm main bar diameter will be provided on column) see on fig 3.9. Diameter of ties bar is 8 mm (according to IS code 456-2000 diameter of ties bar will be provided on column)

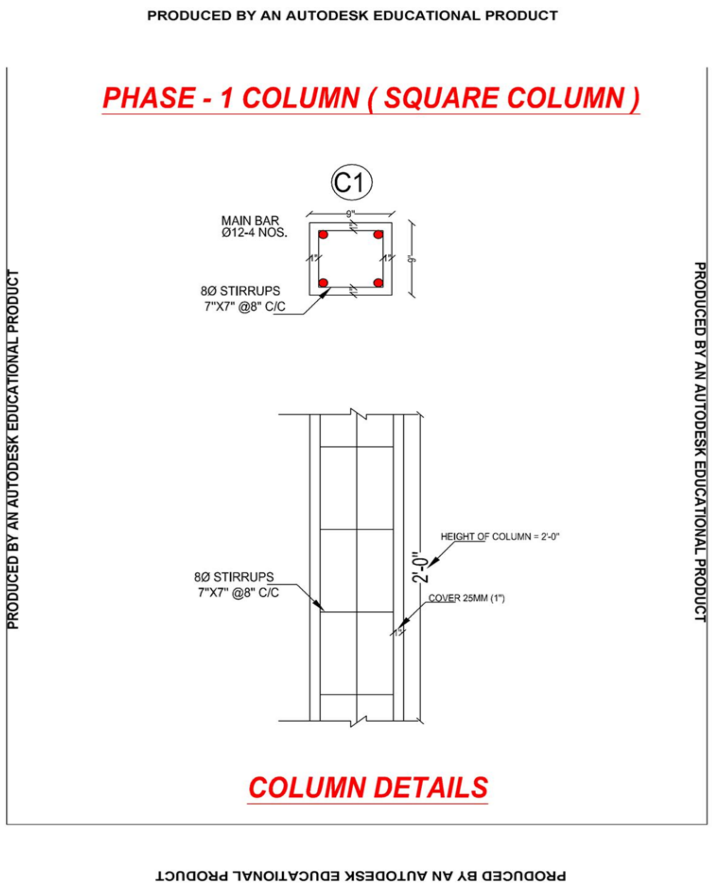


Fig 3.9 Drawing Phase 1 Square column from AutoCAD

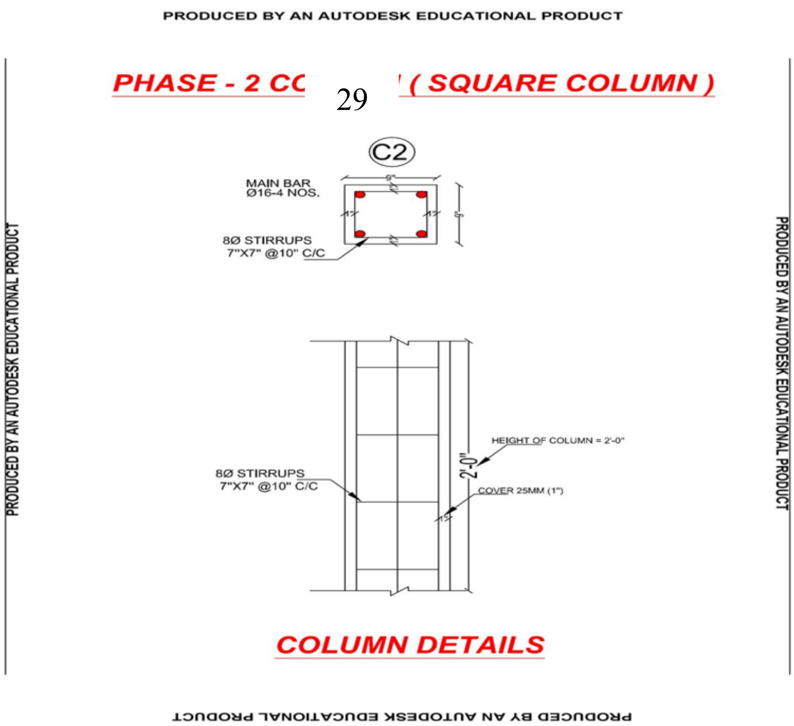


Fig 3.10 Drawing Phase 2 square column from AutoCAD

A total of six short square column specimens are casted along with PCC(Plain cement concrete) had an size of column is Height of column 2 feet and 4-12 mm diameter of main bars and 8 mm diameter lateral ties@192 mm c/c 9"x9" were casted and tested. They included 3 square short column are Transverse Reinforcement spacing of 192 mm c/c and the remaining three column are Transverse Reinforcement spacing of 256 mm c/c . All these six columns are divided into two series. Three columns are tested for each series. The Crushing Load on Short Columns were casted and tested on UTM (Universal testing machine).In this set, six set of column specimens are casted along with RHA admixture had an and size of column is Height of column 2' and 4-16 mm diameter of main bars and 8 mm diameter lateral ties@256 mm c/c 9"x9" were casted and tested. And each set consists of three columns. Columns are developed by replacing the cement with Rice husk ash admixtures. And the minerals admixture column specimen was also casted to compare with remaining column**.** They included 3 square short column are Transverse Reinforcement spacing of 192 mm c/c and the remaining three column are Transverse Reinforcement spacing of 256 mm c/c . All these six columns are divided into two series.

Fig 3.11 Phase I Reinforcement of Column

Fig 3.12 Phase II Reinforcement of Column

3.4 Mix design of concrete

A proportion of **1:1:2** is taken for cement, fine aggregate and course aggregate for casting of column and also mixing 10% RHA (rice husk ash) in concrete. The mixing of these materials is done by using concrete mixture. The columns are cured for 7.14 and 28 days. 12 concrete column specimens of dimensions 9”X9” height of column is 2 feet were made at the time of casting of every column and were kept for curing. The testing of column on UTM (Universal testing machine) the concrete produced was performed and the average compressive strength (f_{ck}) of the column after 7, 14 and 28 days for each column was recorded.

Table 3.1 Design Mix Proportions (M25)

Description	Cement	Sand (fine aggregates)	Coarse aggregate	Water	RHA(rice husk ash)
Mix Proportion (by weight)	1	1	2	0.45	10%
Quantities of materials (Kg/m^3)	143.10	143.10	305.28	42.93	13.68

Fig 3.13 Mixing of Concrete

3.5 Casting of short column

Short column were design in to two phase divided into two part because volumetric ratio were change and divided into two parts spacing were change of transverse reinforcement as per IS-456:2000. All column were design as per IS-456:2000 Use M25 grade of concrete in RCC column and Use 10% rice husk ash mineral admixture in concrete on short column and 12 Column were casted and 6 column were design are diameter of main bar is 12mm and spacing of lateral reinforcement 192 mm and diameter of ties bar will be provided 8 mm and 6 column were design are diameter of main bar is 16 mm and spacing of lateral reinforcement 256 mm and diameter of ties bar will be provided 8 mm and 6 column were casted in plain cement concrete and In 6 column were casted added 10% rice husk ash mineral admixture in concrete. Design of column as per IS-456:2000 is using in column Plain cement concrete and Rice husk ash were used in concrete column and all 12 column were casted and tested on UTM (Universal Testing Machine). All casted column testing on 7,14,28 days and curing with proper and mixed the concrete with help of hand mixing and w/c ratio were used in column 0.45 and Hand compaction were used in casting a column and 10% replacement of RHA (Rice Husk Ash) in concrete and material were used in column are Ordinary Portland cement 43 grade was used and Locally available sand was used as fine aggregate and it was confirmed to Zone III for which specific gravity is 2.63 and water absorption is 0.8% and Crushed stone aggregate of 20 mm size was used as coarse aggregate and tested for which specific gravity was obtained as 2.64 and water absorption is 0.81% and Potable Water free from organic matter, silt, oil, chlorides or acidic material was used for the entire concreting purpose and 12 mm and 16 mm diameter of bars of grade Fe415 are used as longitudinal reinforcement and 8mm diameter ties grade Fe415 are used as lateral reinforcement and The admixtures of Rice husk ash used in short column and The moulds having size 9”X9” and height of mould 2’ which are made with Timber And are used for casting of concrete columns. Many types of frame were used in casting of column and used steel and timber frame were used in concrete column but in this thesis using timber frame casting column.

Fig 3.14 Casting of short column with timber frame

3.6 Testing of short column on UTM (universal testing machine)

All columns were tested on UTM (Universal Testing Machine) and check the crushing load on short column. Check the cracking on short column.UTM is hydraulic pressure generated on UTM. Pressure where generated in column and crack found on column and reading were noted.UTM is universal machine is testing compression and tensile both test can easily and check the easily design column UTM is heavy material tested and easily generated pressure on specimen and hydraulic pressure on column and automatically reading and note down and calculate the compressive stress on column with formula.

Fig 3.15 Column testing on UTM (universal testing machine)

CHAPTER 4

RESULT AND DISCUSION

The loadings on the Column were a concentrated load at each mid of column and the experimental results thus obtained are discussed in terms of observed the load. The load carrying capacity of each column is also described in this chapter. All the columns are tested for their ultimate strengths and it is observed that the column had less load carrying capacity than the strengthened column. The different failure modes of the column were observed for different column.

4.1 Phase I Column after 7 Days Result

Table 4.1 Reading After 7 days

S. No.	% of Rice Husk	Dimension of Short Column	Reading on 7th Day		
			Load (KN)	Area (mm^2)	Strength (N/mm^2)
1.	0	Height of Column is 2 Feet and 4-12 mm diameter of main bars and 8mm diameter of lateral ties @192 mm c/c.	920	52257.96	17.60
2.	10	Height of Column is 2 Feet and 4-12 mm diameter of main bars and 8mm diameter of lateral ties @192 mm c/c.	890	52257.96	17.03

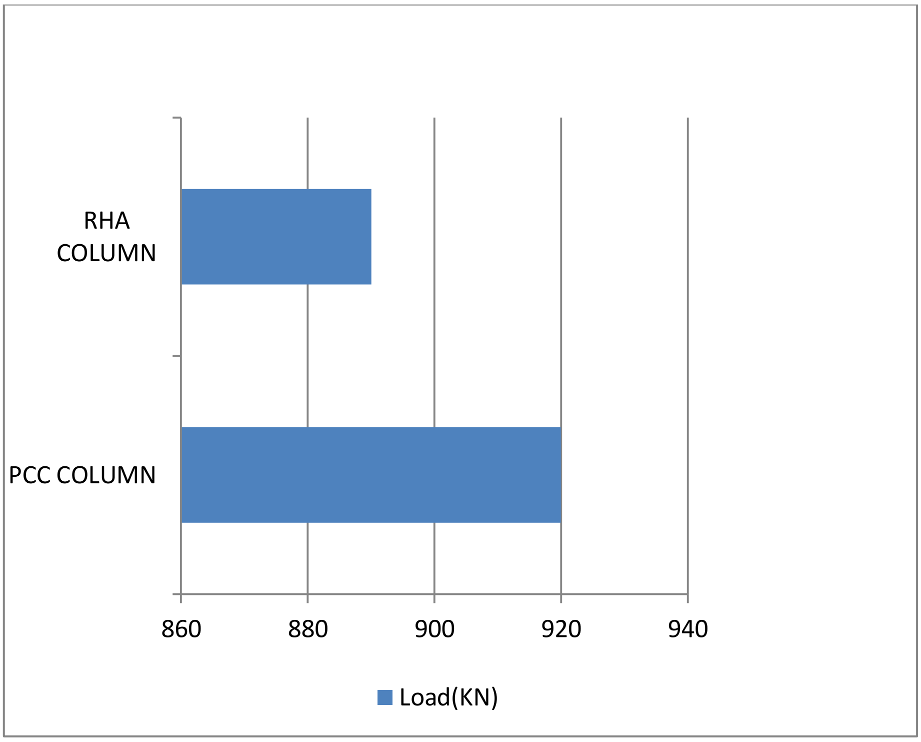


Fig 4.1 Compare the 7 days Phase I column Strength of PCC and RHA column

7^{TH}days result of PCC (Plain Cement Concrete) Column strength is greater than 10% RHA mixed concrete column strength. It is clear see in the result RHA does not improve the strength on 7 days.

4.2 Phase II Column after 7 Days Result

Table 4.2 Reading after 7 days

S. No.	% of Rice Husk	Dimension of Short Column	Reading on 7^{th} Day		
			Load (KN)	Area (mm^2)	Strength (N/mm^2)
1.	0	Height of Column is 2 Feet and 4-16 mm diameter of main bars and 8mm diameter of lateral ties @256 mm c/c.	900	52257.96	17.22
2.	10	Height of Column is 2 Feet and 4-16 mm diameter of main bars and 8mm diameter of lateral ties @256 mm c/c.	880	52257.96	16.83

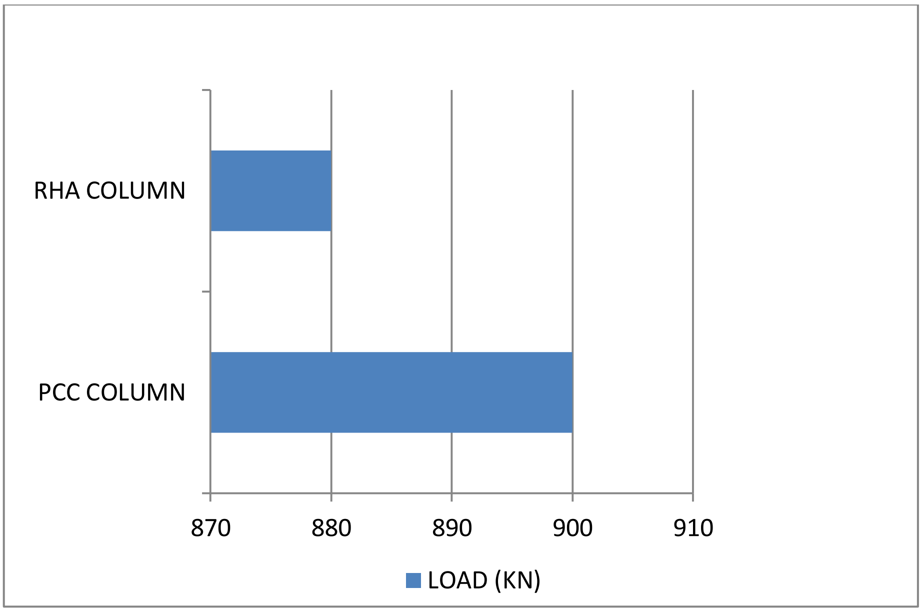


Fig 4.2 Compare the 7 days Phase II column Strength of PCC and RHA column

7^{TH}days result of PCC (Plain Cement Concrete) Column strength is greater than 10% RHA mixed concrete column strength. It is clear see in the result RHA does not improve the strength on 7 days.

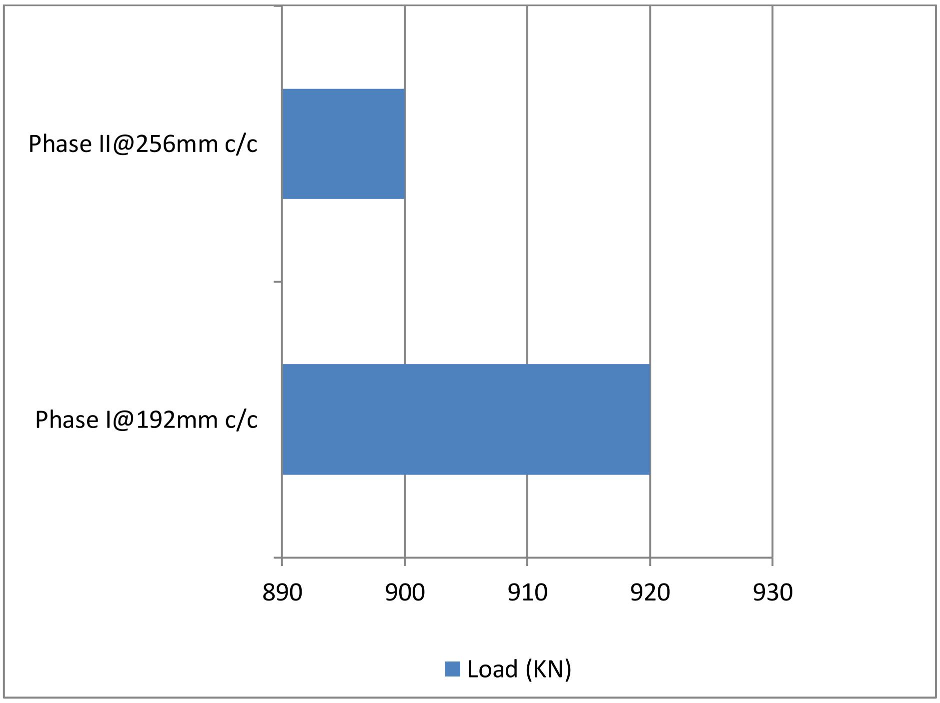


Fig 4.3 Transverse reinforcement spacing change and phase I and phase II PCC column compare strength on 7 days.

Compare PCC Column to volumetric ratio change of transverse reinforcement as per IS Code and result were comes. Effect of increase of spacing of transverse reinforcement it is not comes good strength on 7days compare to volumetric ratio 192 mm c/c is given good strength compare to 256 mm c/c spacing of transverse reinforcement is comes low strength.

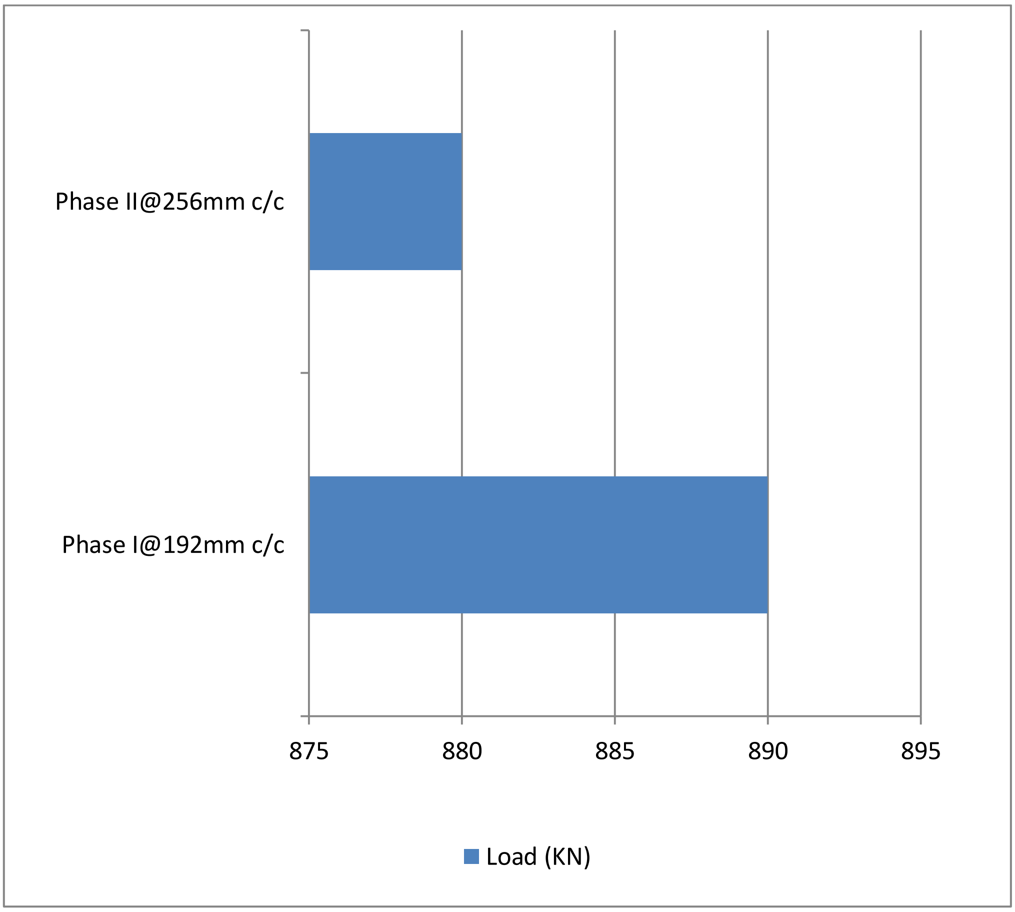


Fig 4.4 Transverse reinforcement spacing change and phase I and phase II RHA column compare strength on 7 days.

Compare RHA Column to volumetric ratio change of transverse reinforcement as per IS Code and result were comes. Effect of increase of spacing of transverse reinforcement it is not comes good strength compare to volumetric ratio 192 mm c/c is given good strength compare to 256 mm c/c spacing of transverse reinforcement is comes low strength.

4.3 Phase I Column after 14 Days Result

Table 4.3 Reading after 14 days

S. No.	% of Rice Husk	Dimension of Short Column	Reading after 14th Day		
			Load (KN)	Area (mm^2)	Strength (N/mm^2)
1.	0	Height of Column is 2 Feet and 4-12 mm diameter of main bars and 8mm diameter of lateral ties @192 mm c/c.	1250	52257.96	23.91
2.	10	Height of Column is 2 Feet and 4-12 mm diameter of main bars and 8mm diameter of lateral ties @192 mm c/c.	1280	52257.96	24.49

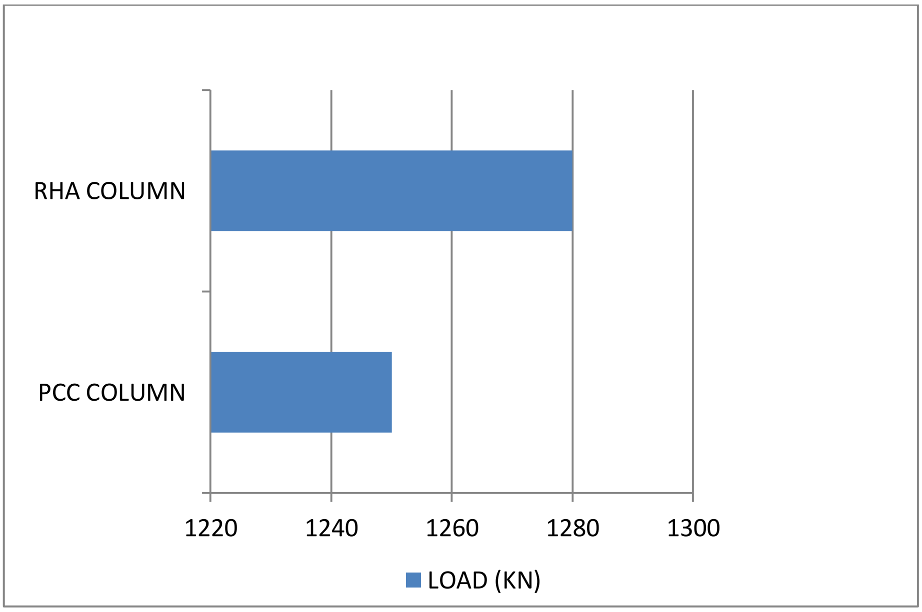


Fig 4.5 Compare the 14 days Phase I column Strength of PCC and RHA column

On 14 days column strength increase the using of 10% RHA mix concrete it is seen in graph on 14 days result RHA gives improve the strength of concrete compare to plain cement concrete strength on 14 days.

4.4 Phase II Column after 14 Days Result

Table 4.4 Reading after 14 days

S. No.	% of Rice Husk	Dimension of Short Column	Reading after 14^{th} Day		
			Load (KN)	Area (mm^2)	Strength (N/mm^2)
1.	0	Height of Column is 2 Feet and 4-16 mm diameter of main bars and 8mm diameter of lateral ties @256 mm c/c.	1210	52257.96	23.15
2.	10	Height of Column is 2 Feet and 4-16 mm diameter of main bars and 8mm diameter of lateral ties @256 mm c/c.	1265	52257.96	24.20

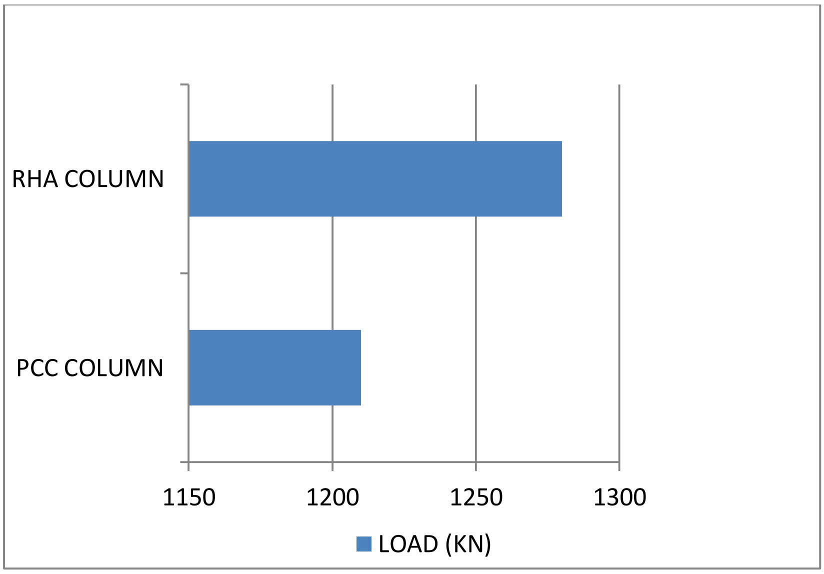


Fig 4.6 Compare the 14 days Phase II column Strength of PCC and RHA column

On 14 days column strength increase the using of 10% RHA mix concrete it is seen in graph on 14 days result RHA gives improve the strength of concrete compare to plain cement concrete strength on 14 days.

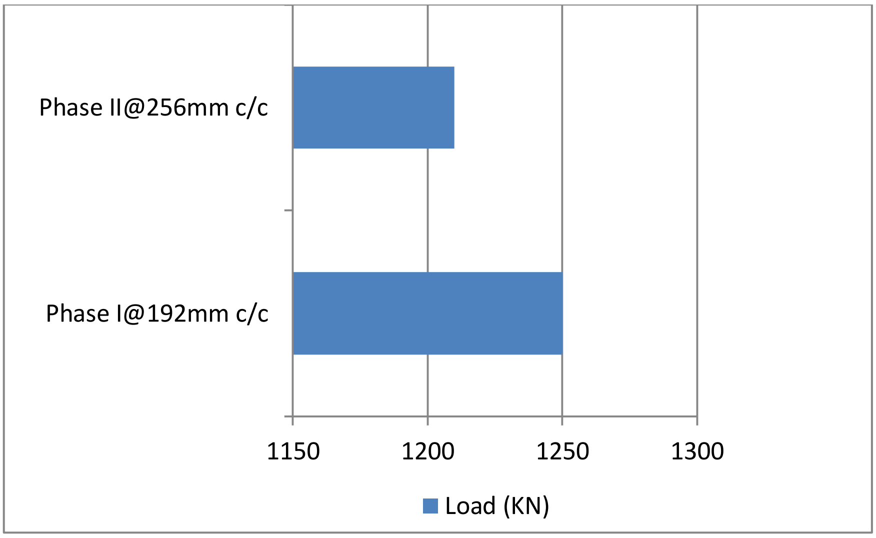
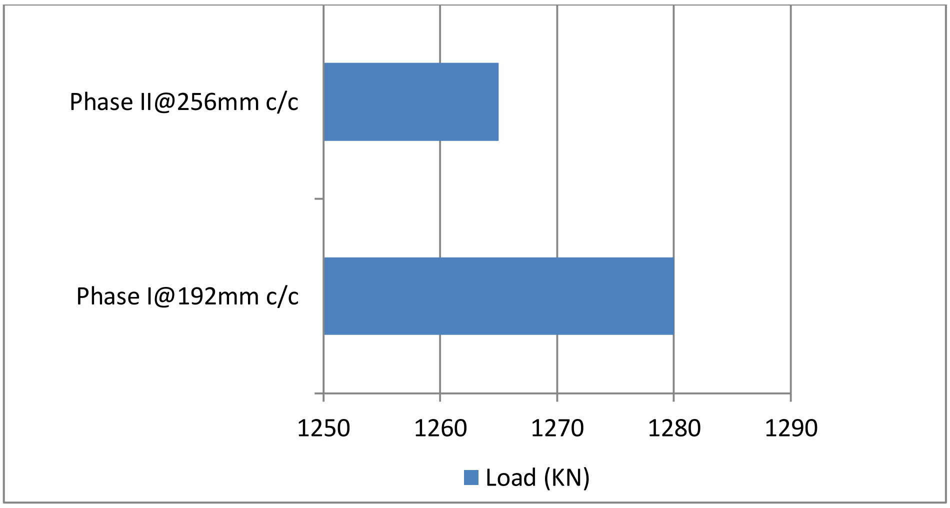


Fig 4.7 Transverse reinforcement spacing change and phase I and phase II PCC column compare strength on 14 days.

Compare to volumetric ratio change of transverse reinforcement as per IS Code and result were comes. Effect of increase of spacing of transverse reinforcement it is not comes good strength compare to volumetric ratio 192 mm c/c is given good strength compare to 256 mm c/c spacing of transverse reinforcement is comes low strength.



. Fig 4.8 Transverse reinforcement spacing change and phase I and phase II RHA column compare strength on 14 days.

Compare to volumetric ratio change of transverse reinforcement as per IS Code and result were comes. Effect of increase of spacing of transverse reinforcement is not comes good strength compare to volumetric ratio 192 mm c/c is given good strength compare to 256 mm c/c spacing of transverses reinforcement is comes low strength.

4.5 Phase I Column after 28 Days Result

Table 4.5 Reading after 28 days

S. No.	% of Rice Husk	Dimension of Short Column	Reading after 28th Day		
			Load (KN)	Area (mm^2)	Strength (N/mm^2)
1.	0	Height of Column is 2 Feet and 4-12 mm diameter of main bars and 8mm diameter of lateral ties @192 mm c/c.	1405	52257.96	26.88
2.	10	Height of Column is 2 Feet and 4-12 mm diameter of main bars and 8mm diameter of lateral ties @192 mm c/c.	1415	52257.96	27.07

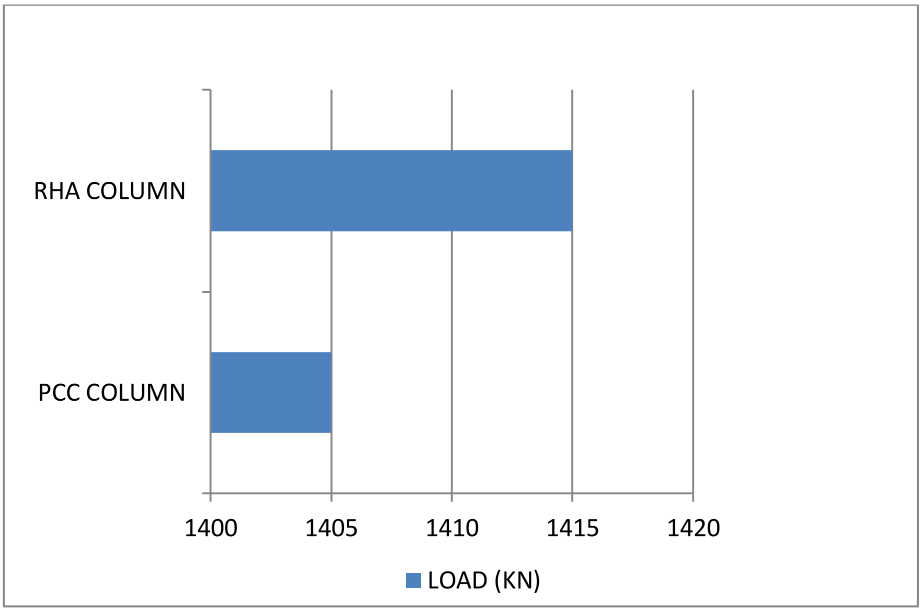


Fig 4.9 Compare the 28 days Phase I column Strength of PCC and RHA column

28 days result of PCC (Plain Cement Concrete) Column strength is greater than 10% RHA mixed concrete column strength. It is clear see in the result on 28 days RHA does not improve the strength.

4.6 Phase II Column after 28 Days Result

Table 4.6 Reading after 28 days

S. No.	% of Rice Husk	Dimension of Short Column	Reading after 28th Day		
			Load (KN)	Area (mm^2)	Strength (N/mm^2)
1.	0	Height of Column is 2 Feet and 4-16 mm diameter of main bars and 8mm diameter of lateral ties @256 mm c/c.	1390	52257.96	26.59
2.	10	Height of Column is 2 Feet and 4-16 mm diameter of main bars and 8mm diameter of lateral ties @256 mm c/c.	1410	52257.96	26.98

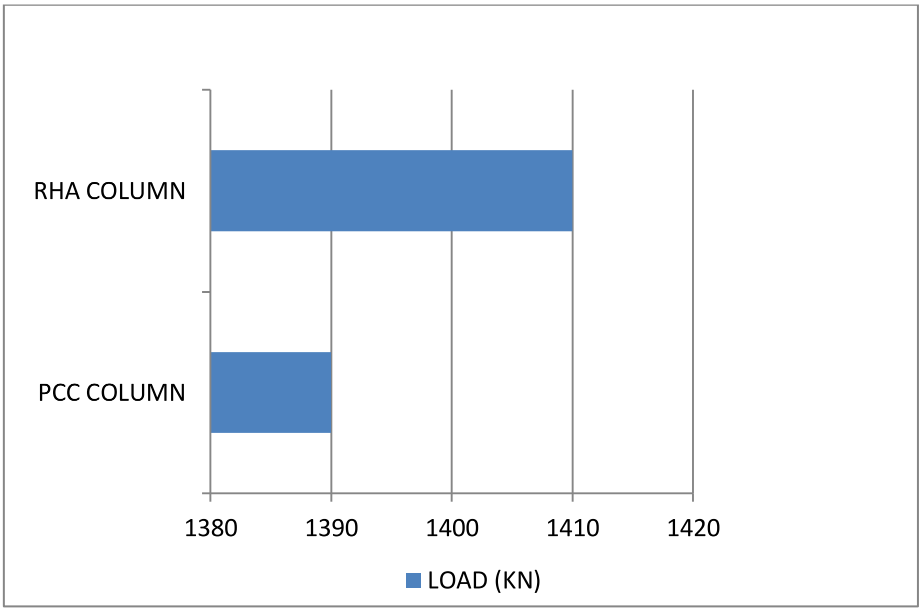


Fig 4.10 Compare the 28 days Phase II column Strength of PCC and RHA column

28 days result of PCC (Plain Cement Concrete) Column strength is greater than 10% RHA mixed concrete column strength. It is clear see in the result on 28 days RHA does not improve the strength.

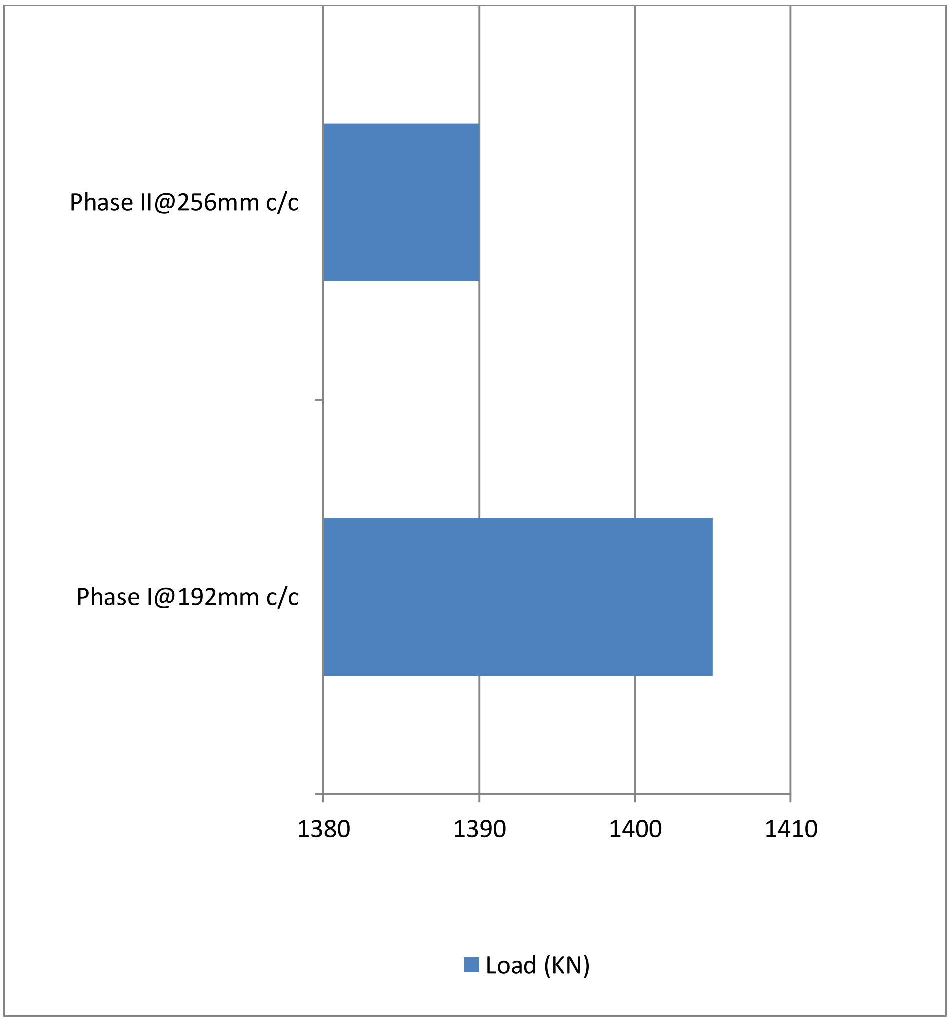


Fig 4.11 Transverse reinforcement spacing change and phase I and phase II PCC column compare strength on 28 days.

Compare to volumetric ratio change of transverse reinforcement as per IS Code and result were comes. Effect of increase of spacing of transverse reinforcement it is not comes good strength compare to volumetric ratio 192 mm c/c is given good strength compare to 256 mm c/c spacing of transverse reinforcement is comes low strength.

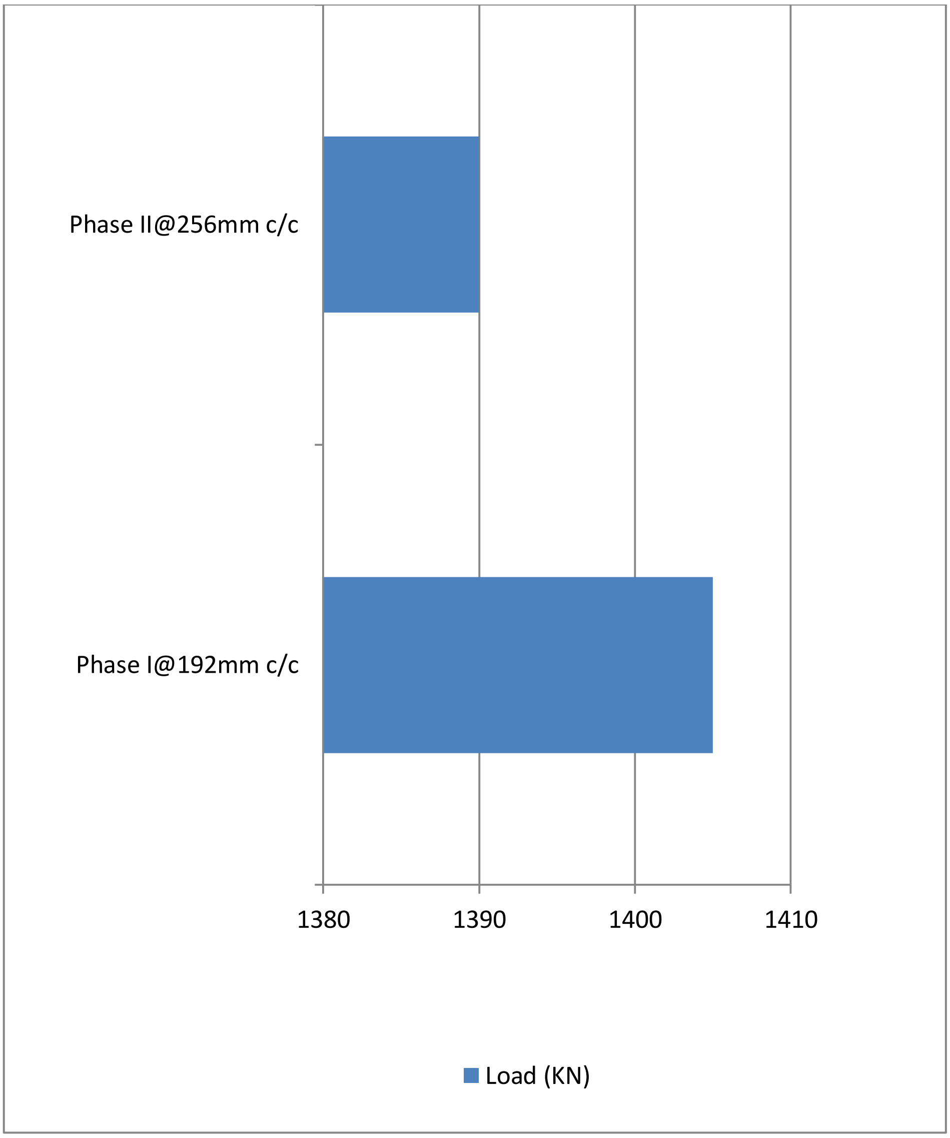


Fig 4.12 Transverse reinforcement spacing change and phase I and phase II RHA column compare strength on 28 days.

Compare to volumetric ratio change of transverse reinforcement as per IS Code and result were comes. Effect of increase of spacing of transverse reinforcement it is not comes good strength compare to volumetric ratio 192 mm c/c is given good strength compare to 256 mm c/c spacing of transverse reinforcement is comes low strength.

CHAPTER 5

CONCLUSION

Based on experiments and test results on fresh & hardened concrete the following conclusions are drawn:

5.1 Improvement in Fresh Concrete Properties:

a. Due to addition of Rice Husk Ash, concrete becomes cohesive and more plastic and thus permits easier placing and finishing of concrete. It also increases workability of concrete.

b. The bulk density of RHA concrete is reducing with increase in RHA content.

5.2 Compressive Strength:

1. Due to addition of RHA it is observed that strength gain is slightly increasing with addition of 10% RHA in normal concrete at 14 days.

2. But in 28 days tests results it is found that with addition of 10% RHA in normal concrete strength is running parallel or more than of normal concrete. Thus 10% RHA is the optimum content for getting nearly equal strength at 28 days.

3. The replacement of cement by RHA in concrete increases, the workability of concrete decreases.

4. Replacement of cement with Rice Husk Ash leads to increase in the compressive strength improved the workability and achieved the target strength at 10% replacement for the grade of concrete.

5. The Pozzolonic activity of rice husk ash is not only effective in enhance the concrete strength, but also in improving the impermeability characteristics of concrete.
6. The optimum replacement level of Rice Husk Ash is found to be to10% for M25 grade of concrete.

7. As the Rice Husk Ash is waste material, it reduces the cost of construction.

8. It helps in reducing the pollution in environment.

9. The strength of the PPC (plain cement concrete) has more than comes in 7 days from the strength of the RHA (Rice Husk Ash) column.

10. The strength of the RHA (Rice Husk Ash) has more than comes in 14, 28 days from the strength of the PPC (plain cement concrete) column.

11. The strength of the Height of column 2 feet and 4-12 mm diameter of main bars and 8 mm diameter lateral ties@192 mm c/c Column has more than comes in 7,14,28 days from the strength of the Height of column 2 feet and 4-16 mm diameter of main bars and 8mm diameter lateral ties@256 mm c/c column.

REFERENCES

[1] Shubham R.Dakhane, Kaustubh P. Gatlewar, Akshay G. Bahale and Alhad D. Raut, "Review on Analysis of Ferro cement – Construction Material". International Conference on Science and Technology for Sustainable Development (ICSTSD) – 2016.

[2] Mohamed A. Tarkhan, "Strengthening of Loaded Reinforced Concrete Columns Using Ferro cement Jackets." IJIRSET-Vol. 4, Issue 12, December 2015.

[3] R. Hafiza, S. Sameen, T. Rahman, "A Review on construction process of Ferro cement sandwich panel" Volume 3,(2015).

[4] Sumit Bansal (2015) - Effect of Rice Husk on compressive Strength of Concrete. (Published by Research Trend).

[5] Shabana salih. K Athira M, Lalan S, Pasum C Refeekha K, Rajimol K, Safna A.M (2015) " result of Coil Wrapping on the Compressive Strength of Short Axially Loaded Concrete Members".

[6] Obilade, I. O. (2014). Use of Rice husk Ash as Partial Replacement for Cement in Concrete. International Referred Journal of Engineering and Applied Sciences.

[7] Makarand Suresh Kulkarni (2014) "Effect of Rice Husk Ash on Properties of Concrete" Journal of Civil Engineering and Environmental Technology, Print ISSN: 2349-8404; Online ISSN: 2349-879X; Volume 1, Number 1; August, 2014.

[8] Veena M and Mini Soman," Strengthening of RC Short Square Columns using Improved Ferro cement Jacketing" International Journal of Scientific & Engineering Research, Volume 5, Issue 7, July-2014.

[9] Manu Chaudhary (2013) “Effect of Partial Replacement of Cement by Rice Husk Ash in Concrete” International Journal of Science and Research (IJSR).

[10] Md. Mozaffar Masud , Arun Kumar (2013) Indian Journal of Science and Technology “ Strengthening of Circular RC column through external confinement mistreatment Ferro cement.

[11] H. M. Mohamed, R. Masmoudi, and Y. Shao (2011) “Slenderness ratio effect on the behavior of steel and carbon-FRP reinforced concrete-filled FRP tubes”, Middle East Conference On Smart Monitoring And Rehabilitation Of Civil Structure.

[12] Hanaa I EISayad, Aiman A Shaheen (2016) “ hearth Resistance of Internally or outwardly confined Reinforcement concrete Columns”.

[13] Abhilash Shukla (2011)“Study of the Properties of Concrete by Partial Replacement of Ordinary Portland cement by Rice Husk Ash” International Journal of Earth Sciences and Engineering, ISSN 0974-5904, Volume 04, No 06 SPL, October 2011.

[14] P. Chandan Kumar and P. Malleswara Rao “Benefits of Use of Rice Husk Ash in Concrete” Jr. of Industrial Pollution Control 26 (2) (2010).

[15] P Sangeetha (2010) “Analysis of FRP wrapped concrete column below uniaxial compression “ Journal of Scientific & Industrial analysis.

[16] Shankar kumar, Arun Kumar, Dhivya, Mahesh Kumar ,Suresh (2010) “ Strength and sturdiness Characteristics of fiber ferroconcrete “ International journal of Science and analysis .

[17] Habeeb, G.A., and Fayyad, M.M. (2009) Rice Husk Ash Concrete: the Effect of RHA Average Particle Size on Mechanical Properties and Drying Shrinkage. Australian Journal of Basic and Applied Sciences.

[18] Chindaprasirt, P., and Rukzon, S. (2008) Strength, porosity and corrosion resistance of ternary blend Portland cement, rice husk ash and fly ash mortar. Construction and Building Materials.

[19] Mahmud, H.B, Hamid, N.B.A.A., and Chia, B.S. (1996) High Strength Rice Husk Ash.

[20] Habeeb, G.A., and Fayyad, M.M. 2009. Rice Husk Ash Concrete: the Effect of RHA Average Particle Size on Mechanical Properties and Drying Shrinkage. Australian Journal of Basic and Applied Sciences.

[21] Mahmud, H.B., Majuar, E., Zain, M.F.M., and Hamid, N.B.A.A. 2009. Mechanical Properties and Durability of High Strength Concrete Containing Rice Husk Ash. Journal of advanced concrete technology.

[22] Mahmud, H.B, Hamid, N.B.A.A., and Chia, B.S.1996. High Strength Rice Husk Ash.

[23] Investigation. In the Proceedings of the 1996 3rd Asia Pacific Conferences on Structural Engineering and Construction. pp. 383-389. 34. Mehta, P.K. 1992. Rice Husk Ash - A unique supplementary cementing material Proceeding International Symposium on Advances in Concrete Technology. Editor. Malhotra, V.M. Athens, Greece.

[24] Mehta, P.K. 1987. Studies on the Mechanisms By Which Condensed Silica Fume Improves the Properties of Concrete: Durability Aspect. In: International Workshop on Condensed Silica Fume in Concrete, Ottawa, and Proceedings.

[25] Mehta, P.K. 1990. Aitcin P.C.C. Principles Underlying Production of High-Performance Concrete. Journal of Cement, Concrete and Aggregates.

EFFECT OF STEEL RATIO AND MINERAL ADMIXTURES ON SHORT COLUMNS

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Abstract: during this thesis the study performance of concrete below compression with steel fiber and Ferro-cement partial add of cement, it's been Studied that the relative below Compression load partial adding of steel fiber and Ferro-cement seem that the quantitative relation ar designed for target strength and end in inflated Stress-strain price.

Keywords: cement, Ferro cement, sand, steel fibre, etc.

I. INTRODUCTION

Concrete could be a semisynthetic construction materials that is most ordinarily utilized in construction add the globe. it's obtained by mix of water, cement, fine mixture, coarse mixture and a few minerals admixtures in necessary proportion ar referred to as concrete. The hardened concrete may be worked as a synthetic stone within which the voids of coarse ar crammed by the fine aggregates and cement. The hardening of concrete is caused by reaction between cement, water, and reaction for an extended time and hardening of concrete robust with the age. The properties of concrete depend upon the amount and proportion of the ingredients utilized in the combo and therefore the management exercised in formwork and natural action.

Concrete is that the boon to construction, because it has varied direct and indirect blessings concrete has several inherent blessings such as:

A. High resistance and weathering action

B. accessibility of ingredients at affordable value

C. High compressive strength

D. Mould ability to any form resulting in branch of knowledge finishes

E. Aesthetic look. so it wide utilized in construction it's some disadvantages they're

F. Low lastingness

G. Poor malleability

H. a lot of crispness

I. High W/C quantitative relation

A Concrete with reinforcement fails suddenly once subject to earthquake and nuclear blast etc. This downside may be avoided if the important sections ar able to bear massive plastic deformation and be in an exceedingly position to soak up massive of strain energy.

Section composed with high strength steel and better steel ratios fail suddenly while not yielding of tension steel, provision of compression reinforcement helps to some extent. however the planning becomes most uneconomical

The improvement in malleability of concrete permits economical use of high strength steel, higher cement quantitative relation and avoids unforeseen failure and additionally the instant curvature characteristics of ferroconcrete section may be brought nearer to it of a steel section and therefore the analysis of intermediate concrete structures get simplified. The concrete with improved malleability is a lot of economical artefact.

The structural that ar designed for seismal resistant demands high malleability. so the malleability of concrete is being improved by confining it in steel binders, as ties in compression member and as stirrups in beams at this time. within the structures that ar statically indeterminate the important section, at that 1st hinge forms ar incidentally additionally the section having most shear force. The stirrup reinforcement, that is provided. Moreover, use of refined arrangement of closely spaced stirrups in confinement columns not solely creates plane of weakness between core {and the|and therefore the|and additionally the} concrete and interrupts the continuity however also adds the matter of steel congestion.Therefore it should not be doable to sufficiently the structure by providing the laterals ties alone however it might be helpful if a supplementary or indirect confinement, additionally to laterals, may be devised. many investigations have maligned that incorporation of discontinuous, distinct and uniformly unfold fibers in concrete will increase lastingness malleability, impact, toughness, flexural and fatigue resistance.

The conclusion highlighted that fibers will provide some confinement, such sort of concrete is termed as Confined fiber ferroconcrete (CFRC). after we use fibers in massive volumes it's tendency to ball. so limitation to the amount of indirect confinement offered by steel additionally. This Limitation confinement necessity the necessity of further confinement may be provided within the variety of Ferro cement shell. Such concrete may be termed as Confined Ferro ferroconcrete (CFRC). gift|this|the current} present investigation is an endeavor to review the strain characteristics of CFRC.

II. LITERATURE REVIEW

A. P Sangeetha one and R. Sumathi 22010 [2] Fiber – Wrapping mistreatment Fiber – strengthened Plastic (FRP) shells is one amongst effective strategies, considerably enhances the strength and malleability of concrete columns. The paper reports the behavior of the GFRP wrapped concrete columns below uniaxial compression. The cross section of the concrete columns thought-about within the work is circular with diameter of 150mm and height 300mm. The Parameters that ar varied within the investigation ar wrapping shell materials, (which includes GFRP Materials Surface Mat(SM), shredded Strand Mat (CSM) and woven Roving Mat (WRM)), variety of Plies (1Ply and 3plies) and amount of natural action (7 Days). Results from a series of the experimental study were reportable and mentioned. The study on little – scale specimens showed that confinement inflated the strength of the concrete columns loaded axially.

B. Shabans Salik K one, Athira M. M. 2, Lalna S.S 3 ,Prasum C. 4 ,Rafeekha K.5 Rajimol K. R 6, Safna A. M seven 2015 [3] This paper evaluates the performance of short concrete compression members strong with fiber rope wrapping, below axial compression. From the study on small-scale specimens, it's been seen that the fiber rope wrapped specimen exhibit important increase in strength, as compared to regulate specimen, because of the confinement by rope wrapping. The tests were allotted with ropes of various diameters zero.6cm, 1cm and 1.4cm at spacing of zero.0h, 0.1h, 0.2h and 0.3h, wherever h is that the height of the specimen. most improvement was obtained for wrapping with fiber rope of diameter one.4 cm at 0.0h spacing. The strength was found to be inflated with increase in diameter of rope and faded with increase in spacing. the prices for unit improvement with varied wrapping were figured out and therefore the methodology was found to be terribly cost-efficient. because the weight of fiber rope is negligibly little, it's much no impact on footing style.

C. A.R. Rahai 1 ,P.Sadeghian a pair of and M.R. Ehsani 32008 [4] This paper presents the results of experimental studies concerning concrete cylinders confined with high-strength carbon fiber strengthened compound (CFRP) composites. Forty little scale specimens (150×300 mm) were subjected to uniaxial compression up to failure and stress-strain behaviors were recorded. the varied parameters like wrap thickness and fiber orientation were thought-about. completely different wrap thicknesses (1, 2, 3, and four layers), fiber orientation of 0o, 90o, ±45o and combos of them were investigated. The results incontestible important improvement within the compressive strength, stiffness, and malleability of the CFRP-wrapped concrete cylinders as compared to unconfined concrete cylinders.

D. Katsuki Takiguchi one And Abdullah 22000 [5]n Investigation by several researchers have indicated that by providing external confinement at plastic region or over the whole strengthened columns, the strength and malleability may be increased. during this paper, a strengthening methodology mistreatment circular ferrocement jacket to enhance the confinement of a substandard column was investigated and compared with management specimens and completely different strengthening strategies. 5 1:6 scale model sq. columns were created and are tested below constant axial load whereas at the same time being subjected to cyclic lateral load. The loading system utilized in this experiment displaced the tested columns in an exceedingly double bending. 2 columns were tested as management specimens; one column was strong with circular Ferro cement jacket and were compared with those of alternative 2 identical sq. RC columns strong circularly with plate and carbon fiber. The management specimens suffered shear failure and important degradation of strength throughout testing whereas the strong columns showed ductile flexural response and better strength. The check results indicate that circular Ferro cement jacket may be a good different material to strengthen ferroconcrete column with in adequate shear resistance.

E. Hanaa I EI Sayad one and Aiman A. Shaheen 22011 [6] The aim of this investigation is first off to judge the various strategies used for confining the ferroconcrete (R.C) columns either internally or outwardly. Secondly, the result of warming on the performance of confining strategies is studied mistreatment the pc program “ANSYS five.4”. Beside the normal crosswise steel ties, the interior confinement was glad by steel fibers or a cage of xpanded metal mesh within the ties, whereas external confinement was achieved by wrapping the studied columns with Ferro cement layers or GFRP sheets. Six R. C columns were ready, namely, the management column strengthened historically with crosswise ties solely, 2 columns containing

I Chronicles and a couple of steel fibers, one column strengthened to boot with a cage of distended metal mesh, 2 columns wrapped with either Ferro-cement laminates or fibre strengthened plastics (GFRP). The columns were tested below axial hundreds to judge the result of the various confining strategies on the final word capability and malleability. it had been found that adding a pair of steel fibers or reinforcing the column with a cage of distended metal mesh within the ties gave virtually similar results (26% increase within the final capability compared therewith of the management column). Despite that {the final|the last word|the final word} capability of the column wrapped with GFRP was the best among the studied columns (37% increase within the ultimate capacity), its malleability was the bottom. The constant quantity study mistreatment ANSYS five.4 showed that the R.C columns containing steel fibers were less littered with hearth than the opposite columns. it had been additionally found that the final word capability of R.C columns wrapped with GFRP was reduced by hearth to a high degree (approximately fifty three reduction within the final capacity).

F. PSangeetha 2006 [7] Fiber wrapping or enclosure of columns with fiber-reinforcedplastic (FRP) sheets considerably enhances strength and malleability of concrete. to research the behavior of concrete columns confined by fiber strengthened compound (FRP) sheets below uniaxial compression, analytical models were resolved mistreatment Finite component methodology (FEM) against revealed experimental information. Cross sections of concrete columns in analysis ar categorised into circular, sq. and rectangular sections. Finite component Analysis (FEA) will effectively simulate the behavior of concrete columns confined by FRP sheets once the correct numerical model is adopted. Results from a series of the analysis on small-scale specimens showed that confinement increase strength (20-25) and malleability of concrete columns loaded axially. ANSYS (version half-dozen.0) offers a series of terribly sturdy nonlinear capabilities for styles and analyses.

G. Emdad K. Z. Balanji 1, M. Neaz ruler a pair of Muhammad N.s. Hadi three 2016 [8] The strength and malleability of high strength concrete columns improve with the addition of steel fiber. This paper reports the behavior of circular High Strength Concrete (HSC) columns strengthened with Hybrid Steel Fibers (HSF) below completely different loading conditions. during this study, HSF consisted of a mix of macro steel fibers and small steel fibers. a complete of eight circular specimens of 205 mmdiameter and 800 millimeter height were forged and tested. All specimens were strengthened with same quantity of steel reinforcements. The specimens were divided into 2 teams of 4 specimens. cluster RC (reference group) contained no steel fibers. cluster HSF (hybrid steel fibers) contained a pair of.5% by volume of HSF. From every cluster one specimen was tested below coaxial loading, one below twenty five millimeter eccentric loading, one below fifty millimeter eccentric loading, and one below four-point loading. The results showed that the specimens strengthened with HSF achieved higher strength and malleability compared to RC specimens below completely different loading conditions. it had been additionally determined that the presence of HSF delayed the spalling of the concrete cowl

H. Azadeh Parvin one and David Brighton a pair of 2014 [9] In recent years, the repair of unstrengthened and broken ferroconcrete member by external bonding like ferrrocement laminate is increasing that demands would like of investigations on behavior of ferrocement confinements. important quantity of labor has been allotted on confinement of column with ferrocement laminates considering amendment in parameter like varieties of meshes with completely different sizes, concrete grade, height of column, etc. during this study, use of ferrocement as associate external confinement to concrete specimen is investigated with respect to layers of confinement and orientation of meshes. The effectiveness of confinement is achieved by scrutiny the behavior of confined specimen therewith of unconfined specimen.

I. Shankarkumar V1 ,Arun K 2, Dhivya P 3, Mahesh Kumar M4, Suresh adult male R5 2010 [10] Invention of latest strategies in strengthening concrete is below work for many years. On the track of such invention Fiber strengthened Composite materials plays a major role. the most perform of fiber reinforcement is to hold the load on its length and additionally to supply stiffness and strength in one direction. FRP therefore alters the compressive strength, lastingness and flexural strength of concrete to an honest extent and therefore it imprints as an honest answer for strengthening concrete. FRP materials may be outwardly bonded or wrapped to the present structure; therefore they will even be used for rehabilitation works. There ar 3 major varieties of fiber strengthened polymers utilized in construction works. they're fibre strengthened compound (GFRP), Carbon fiber strengthened compound (CFRP) and Aramid fiber strengthened compound (AFRP). within the gift investigation the result of GFRP on M25 and M50 concrete combine is studied at 2 cases. First, result of GFRP on the compressive and flexural strength of M25 and M50 concrete combine with relevance variety of layers, and second result of GFRP on compressive strength M25 and M50 concrete combine with relevance variety of layers at 2000C temperature that is termed as sturdiness studies.

J. Md. Mozaffar Masud1 and Arum Kumar2 2013 [11] The present study investigates the result of confinement mistreatment ferrocement as wrapping material on the circular RC columns below coaxial loading condition. Methods: Experimental studies were allotted on the confining result mistreatment external confinement technique with one layer and 2 layers of GI wire mesh below concentrically loaded condition. All columns were tested by uniform coaxial compressive load from prime with a hydraulic compression testing machine of capability 1000KN. Findings: Most of the researches have done on confining result of either long column or short column (slenderness quantitative relation quite 3). This paper demonstrates the confining result on short column having slenderness quantitative relation is a smaller amount than three, such a column is named pedestal. Pedestal could be a variety of short column that is employed as a base support for steel structure, sculpture or jar. to guard the column of steel structure from corrosion that's in direct contact of soil, pedestal is provided. throughout earthquake such a structure will collapse or maybe cracks will develop. Hence, Ferro cement structures ar extremely ductile and energy dissipating material which will undergoes massive deformations while not collapsing throughout earthquakes. Even the malformed structures may be strong at terribly low value when deformation. Steel jacketing has proved to be a good live for strengthening or retrofitting and has been wide utilized in follow, however the engineering community is presently searching for alternatives. Applications/Improvements: Material like Ferro cement is oldest, value effective methodology emerges an alternate answer for strengthening of ferroconcrete column. External confinement or encasing of column with Ferrocement enhances the strength and malleability of concrete column.

III. CONCLUSION

A. On the premise of check result, {we will|we will|we are able to} counsel that stress-strain property of the concrete can more be improved by mix another varieties of mineral admixture like 'Blast-furnace scum (BFS), ash (FA), Rice Husk ash (RHA)' as future work.

B. On the premise of result get from current work a study is additionally steered for Flexural strength and Split lastingness connected properties in future.

C. On the premise of result get from current work a study is additionally steered for Bond strength by Pull out check connected properties in Future.

D. The confinement of the reinforcement in column with fibers has improved stress-strain behavior compared to plane concrete.

E. The confinement of Ferro cement shell with fibers has improved the strain strain behavior of the concrete

REFERENCES

[1] Piyush Sharma "Analytical analysis on Ferro cement: style, Strength and utility aspects " IJSRSET 2016.

[2] P. Sangeetha, R Sumathi "Behavior of fibre wrapped concrete columns below uniaxial compression" International Journal of Advanced engineeringtechnology.

[3] Shabana salih. K Athira M, Lalan S, Pasum C Refeekha K, Rajimol K, Safna A.M " result of Coil Wrapping on the Compressive Strength of Short Axially Loaded Concrete Members".

[4] A R Rahai, P Sadeghian and M R Ehsani "Experimental Behavior of concrete cylinders confined with CFRP composites " The ordinal World Conference on Earthquake.

[5] Katsuki Takiguchi, Abdullah " Experimental study on Reinforcement concrete column strong with ferrocement jacket"

[6] Hanaa I EISayad, Aiman A Shaheen " hearth Resistance of Internally or outwardly confined Reinforcement concrete Columns "

[7] P Sangeetha "Analysis of FRP wrapped concrete column below uniaxial compression " Journal of Scientific & Industrial analysis.

[8] Emdad Balanji , M Neaz ruler, Muhammad Hadi " Performance of high strength concrete columns reinforcement with hybrid fiber below completely different loading conditions.

[9] "FRP Composites strengthening of concrete columns below varied loading conditions " Azadeh Parvin , David Brighton.

[10] Shankar kumar, Arun Kumar, Dhivya, Mahesh Kumar , Suresh adult male " Strength and sturdiness Characteristics of fiber ferroconcrete " International journal of Science and analysis .

[11] Md. Mozaffar Masud , Arun Kumar Indian Journal of Science and Technology " Strengthening of Circular RC column through external confinement mistreatment Ferro cement.

EFFECT OF STEEL RATIO AND MINERAL ADMIXTURES ON SHORT COLUMNS

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ABSTRACT:- An experimental study is carried out to investigate the effect of type of lateral reinforcement as a confining material and also the effect of mineral admixtures on compressive strength of concrete in the column composite. For this, the work is carried out in two phases. In the first phase, Short columns were casted by varying volumetric ratio and spacing of lateral reinforcement. The effect of spacing, volumetric ratio on ultimate load carrying capacity of short columns is studied. And In the second phase, Short columns mineral admixtures like RHA are developed. All the columns were tested in the Universal Testing Machine of 2000 kN capacity. The effect of these admixtures on ultimate load capacity of short columns is studied. Also, modes of failures, crack pattern, stress-strain patterns are also studied in both stages. The test results indicate that with increase in volumetric ratio of steel, the strength and ductility of column increases and the columns in which 10% RHA is replaced shows high strength. From the modes of failure it is observed that the short columns shows brittle fracture and zone of rupture is observed at top and bottom ends of the columns and this zone of rupture is decreases with the decrease in spacing of ties. The spacing of ties is strongly influencing zone of rupture in all type of columns is observed in this study.

Keywords: Short Column, Volumetric Ratio, Fly Ash, RHA, Mode of Failure.

INTRODUCTION

Column is the most authoritative structural element because it carries the entire load of the structure. The failure of the column leads to the total collapse of the whole frame structure as it transmits the vertical loads i.e. loads from roof slab and beam, including self -weight to the foundation. Now-a-days R.C.C. columns are widely used. To achieve overall stability of structures, inelastic deformability of reinforced concrete columns is essential and it is achieved only through proper confinement of the concrete. At the same time, concrete is being used for various constructional purposes to make it suitable for different conditions. In these conditions, ordinary concrete may fail to exhibit the required strength and durability. For this, Admixtures are added in concrete to improve the quality of concrete. Mineral admixtures like fly ash, silica fume, ground granulated blast furnace slag, meta kaolin and rice husk ash which possess certain characteristics through which they influence the properties of concrete differently .The boon to construction, because it has varied direct and indirect blessings concrete has several inherent blessings such as:

A. High resistance and weathering action

B. accessibility of ingredients at affordable value

C. High compressive strength

D. Mould ability to any form resulting in branch of knowledge finishes

E. Aesthetic look. So it wide utilized in construction it's some disadvantages they're

F. Low lastingness

G. Poor malleability

H. a lot of crispness

I. High W/C quantitative relation

OBJECTIVE

The objectives of this work are:

To study the load carrying capacity of columns which are confined with different types of lateral reinforcements and with different types of admixtures.

To study the effect of volumetric ratio on short columns

To study the crack patterns and modes of failure of short columns.

To study the zone of rupture in the short columns.

To study load – deflection and stress the columns.

Advantages of Mineral Admixtures RHA

The major reasons for using admixtures are:

1. To lower the heat of hydration and thermal shrinkage.
2. To increase the water tightness.
3. To reduce the alkali – aggregate reaction.
4. To improve resistance to sulphate attacks.
5. To improve extensibility of concrete.
6. To reduce dissolution and leaching.
7. To improve workability.
8. To reduce the cost of concrete construction.

EXPERIMENTAL PROGRAM

The present work is mainly focused on studying the effect of type of lateral reinforcement as a confining material and also the effect of mineral admixtures on compressive strength of concrete in the column composite. The short columns of size height 2 feet and length and breadth of column 9X9 inch were selected. The short columns were casted and are tested for ultimate load carrying capacity. The above work is carried out in two phases.

First phase of work is targeted to study the effect of load carrying capacity of the short columns, keeping steel ratio of longitudinal reinforcement constant by varying percentage of lateral reinforcement.

Second phase is focused on development of short columns with RHA admixtures and to study the effect of load carrying capacity of columns.

Also the modes of failures, crack pattern are observed in two phases of work

Design of short column

(i) Make a short column height of column 2' feet and size of column 9 x 9 " inch (according to IS code 456-2007 height of column is less than 3 meter is called short column)

(ii) 25mm cover will be provided on short column (according to IS code 456-2007 minimum cover will be provide on short column 25mm)

(iii) Diameter of main bar 12mm (according to IS code 456-2007 minimum 12mm main bar diameter will be provided on column)

(iv) Diameter of ties bar is 8mm (according to IS code 456-2007 diameter of ties bars will be provided).

(v) Use M25 grade of concrete in RCC column

(vi) Use 10% rice husk ash mineral admixture in concrete on short column.

(vii) 12 Column were casted and 6 column were design are diameter of main bar is 12 mm and spacing of lateral reinforcement 192 mm and diameter of ties bar will be provided 8 mm and 6 column were design are diameter of main bar is 16 mm and spacing of lateral reinforcement 256 mm and diameter of ties bar will be provided 8 mm.

(viii) 6 column were casted in plain cement concrete and 6 column were casted added 10% rice husk ash mineral admixture in concrete.

(ix) All column were tested on UTM (Universal Testing Machine) and check the crushing load on short column.

(x) A total of six short square column specimens are casted along with PCC(Plain cement concrete) had an size of column is Height of column 2 feet and 4-12mm diameter of main bars and 8mm diameter lateral ties@192mm c/c 9x9inch were casted and tested. They included 3 square short column are Transverse_Reinforcement spacing of 192 mm c/c and the remaining three column are Transverse Reinforcement spacing of 192 mm c/c . All these six columns are divided into two series. Three columns are tested for each series. The Crushing Load on Short Columns were casted and tested on UTM (Universal testing machine).

(xi) In this phase, six set of column specimens are casted along with minerals admixture had an and size of column is Height of column 2 feet and 4-16mm diameter of main bars and 8mm diameter lateral ties@256mm c/c 9x9inch were casted and tested. And each set consists of three columns. Columns are developed by replacing the cement with Rice husk ash admixtures. And the minerals admixture column specimen was also casted to compare with remaining column. They included 3 square short column are Transverse_Reinforcement spacing of 256 mm c/c and the remaining three column are Transverse Reinforcement spacing of 256 mm c/c . All these six columns are divided into two series. Three columns are tested for each series. The Crushing Load on Short Columns were casted and tested on UTM.

COMPARE THE COMPRESSIVE RESULT OF PLANE CEMENTCONCRETE AND RHS MIXED CEMENTCONCRETE

1. COMPRESSIVE STRENGTH (PLANE CEMENT CONCRETE)

Average value of all the test specimens.

1. The 7 Days Compressive Strength of given cement sample is found to be...**P=F/A**=400000/22500=17.77N/mm^2.
2. The average 28 Days Compressive Strength of given cement sample is found to be….**P=F/A**=610*1000/22500=27.11N/mm^2.

P=Pressure on concrete cube. **F**=Force on applied concrete cube. **A**=Surface area of concrete cube.

1. COMPRESSIVE STRENGTH (RHA MIXED CEMENT CONCRETE)

3. The 7 Days Compressive Strength of given cement sample is found to be...**P=F/A**=(380 X 1000)/22500=16.88N/mm^2.
4. The average 28 Days Compressive Strength of given cement sample is found to be….**P=F/A**=(625X1000)/22500=27.77N/mm^2.

P=Pressure on concrete cube. **F**=Force on applied concrete cube. **A**=Surface area of concrete

International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 06 Issue: 05 | May 2019 www.irjet.net p-ISSN: 2395-0072



COLUMN TESTING ON UTM **Reinforcement of column** ***Casting of Column***

RESULT-

1 Column Specimen

Grade of Concrete	% of rice husk ash	Dimension of short column	First crack in 7 days (kN)	First crack in 14 days (kN)	First crack in 28 days (kN)
M25	0	Height of column 2 feet and 4-12mm diameter of main bars and 8mm diameter lateral ties@192mm c/c	920	1250	1405
M25	10	Height of column 2 feet and 4-12mm diameter of main bars and 8mm diameter lateral ties@192mm c/c	890	1280	1415

2 Column Specimen

Grade of Concrete	% of rice husk ash	Dimension of short column	First crack in 7 days (kN)	First crack in 14 days (kN)	First crack in 28 days (kN)
M25	0	Height of column 2 feet and 4-16mm diameter of main bars and 8mm diameter lateral ties@256mm c/c	900	1210	1390
M25	10	Height of column 2 feet and 4-16mm diameter of main bars and 8mm diameter lateral ties@256mm c/c	880	1265	1410

CONCLUSION:-

Based on experiments and test results on fresh & hardened concrete the following conclusions are drawn:

Improvement in Fresh Concrete Properties:

a. Due to addition of rice Husk ash, concrete becomes cohesive and more plastic and thus permits easier placing and finishing of concrete. It also increases workability of concrete.

b. The bulk density of RHA concrete is reducing with increase in RHA content.

Compressive Strength:

1. Due to addition of RHA it is observed that strength gain is slightly increasing with addition of 10% RHA in normal concrete at 14 days.

2. But in 28 days tests results it is found that with addition of 10% RHA in normal concrete strength is running parallel or more than of normal concrete. Thus 10% RHA is the optimum content for getting highly strength at 28 days.

3. As the replacement of cement by RHA in concrete increases, the workability of concrete decreases.

4. Replacement of cement with Rice Husk Ash leads to increase in the compressive strength improved the workability and achieved the target strength at 10% replacement for the grade of concrete.

5. The Pozzolonic activity of rice husk ash is not only effective in enhance the concrete strength, but also in improving the impermeability characteristics of concrete.

6. The optimum replacement level of Rice Husk Ash is found to be added 10% in M25 grade of concrete.

7. As the Rice Husk Ash is waste material, it reduces the cost of construction.

8. It helps in reducing the pollution in environment.

9. The strength of the PPC (plain cement concrete) has more than comes in 7 days from the strength of the RHA (Rice Husk Ash) column.

10. The strength of the RHA (Rice Husk Ash) has more than comes in 14, 28 days from the strength of the PPC (plain cement concrete) column.

11. The strength of the Height of column 2 feet and 4-16mm diameter of main bars and 8mm diameter lateral ties@192mm c/c Column has more than comes in 7,14,28 days from the strength of the Height of column 2 feet and 4-16mm diameter of main bars and 8mm diameter lateral ties@256mm c/c column.

REFERENCES

[1]Umesh K. Sharma, Pradeep Bhargava and S.K.Kaushik. “Behavior of Confined High Strength Concrete Columns Under Axial Loaded”. Asian Journal of advanced concrete technology Vol.3, No.2, (2005), Pages 267-281.

[2]Shafqat A & Ali A. A study on “Lateral Confinement of RC Short Column”. Journal of ISSN 1013-5316, vol.24, no 4, pages 371-379.

[3]Antonius. A. “Studies on the provisions of confining reinforcement for high strength concrete column”. 2nd International Conference on Sustainable Civil Engineering Structures and Construction Materials 2014 (SCESCM 2014).

[4]A. Alqatamin1 A. Talposi. “The Action of Short Columns at Reinforced Concrete Building Constructions”. Bulletin of the Transilvania University of Brasov, Vol. 2 (51) - 2009, and Series I.

[5]B.G. Vishnuram, K. Subramanian, P. Muthupriya. “Experimental Investigation On High Performance Reinforced Concrete Column With Silica Fume And Fly Ash As Admixtures”, Asian Journal of Civil Engineering (Building and Housing) Vol.12, No.5 (2011), Pages 597-618.

[6]P. Muthupriya, Dr. K. Subramanian, B.G. Vishnuram. “Investigation On Behavior of High Performance Reinforced Concrete Columns With Metakaolin And Fly Ash as Admixture”, International Journal of Advanced Engineering Technology E-ISSN 0976-3945, Vol. II, Issue I, January-March (2011), pages 190-202.

[7]Sadaqat Ullah Khan, Muhammad Fadhil Nuruddin, Tehmina Ayub, and NasirShafiq. “Effects of Different Mineral Admixtures on the Properties of Fresh Concrete “, Scientific World Journal, Volume 2014, 11 Pages.