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

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

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.

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