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Evaluation of Compressive Strength of RCC Column Strengthened Using Ferrocement

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Abstract: ***Reinforced concrete used abundantly as a construction material both in developed and developing country. This material often suffer damage due to natural disaster like earthquake, environmental impact etc. Column is the important structural element in building that transfer load of superstructure to the foundation. To strengthen damaged column various material like glass fiber, aramid fiber, ferrocement etc. can be used. In this study, Short RCC column specimen tested under different percentage of ultimate load (50%, 75% &100%), then this preloaded column specimen strengthened using ferrocement and retested to failure to find its ultimate load carrying capacity. Test result show that strengthening preloaded column using ferrocement improves its load carrying capacity.***
Keywords: RCC column, Strengthening of column, ferrocement jacketing

I. INTRODUCTION

Reinforced concrete used abundantly as a construction material. The structures made of this material often suffer damage due to natural disaster like earthquake, flood, tsunami, environmental impact etc. This damage may cause failure of structural element. The failure of authoritative structural element like column may result into severe damage of frame structure as it is the only element which transfer the load of the super structure to the foundation. There are various material like glass fiber, aramid fiber, ferrocement etc. for strengthening RCC column.

In developing countries the ferrocement can be an efficient restrengthening technique as its raw materials are easily available. Application of this strengthening technique is simple and does not need skilled labor. Due to uniform dispersion of reinforcement in mortar it has homogeneous and isotropic properties in two direction. Strengthening of column using ferrocement consist surface preparation, wrapping of wire mesh, application of mortar and curing.

II. EXPERIMENTAL PROGRAMME

The Following Section deals with the Experimental Work Carried out in this Study:

A. Priliminary Investigation

The preliminary investigation of experimental work deals with the testing of constituent materials used for casting of column specimen as well as preparation of mortar for ferrocement.

1) *Cement:* Ordinary Portland cement of 53 grade conforming to IS 12269.

TABLE I: properties of cement

Property	Value
Initial setting time	35 minute
Final setting time	300 minute
Standard consistency	30%

2) *Fine aggregate:* Natural river sand having fineness modulus 2.44 and specific gravity 2.52 and conforming to zone II of IS 383:1967 used as fine aggregate.

3) *Coarse aggregate*: Crushed coarse aggregate having specific gravity 2.7 and maximum size of 20 mm was used.

4) *Water:* Potable water was used for casting of column specimen as well as preparation of mortar.

5) *Mix proportion:* Constituent mix prepared for M25 grade of concrete having mix proportion 1:1.45:2.9 and w/c ratio 0.45 conforming to IS 10262:2009. Six cubes were tested at 7 & 28 days for compressive strength determination. The average compressive strength at 28-days was 30.5 N/mm^2.

6) *Column specimen detail:* Short RCC column having cross sectional area 150 mm ×150 mm and height 600 mm was used for experimental work. The detail of column specimen shown below:

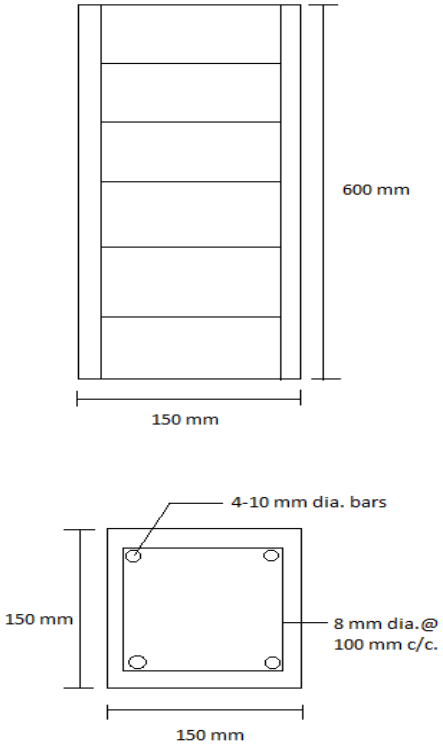

Fig. 1 Column specimen detail

7) *Ferrocement jacketing:* After testing, Pre-loaded column specimen were strengthened using ferrocement containing GI welded wire mesh of 15 mm×15 mm square opening and 1 mm diameter wire and mortar mix of 1:2 proportion with 0.4 w/c ratio with confinement thickness of 15 mm. Jacketed column specimen further cured for 14 days and retested to find its ultimate load carrying capacity.

Fig. 2 ferrocement jacketing

B. Casting of Column Specimen & Testing:

Short RCC column specimen of size 150 mm×150 mm cross-section area and height 600 mm of M25 grade concrete were casted in wooden mould and demoulded after 24-hours of casting and cured for 28-days.

After curing, column specimen were tested under different percentage of ultimate load (50%.75% & 100%) in UTM of 1000 kN capacity to find its load carrying capacity.

Fig. 3 testing of column specimen

TABLE II: Specimen detail and designation

Column specimen sample id	Compressive load (kN)
100-1 (ultimate load)	497.30
75-1 (75% ultimate load)	379
50-1 (50% ultimate load)	249
100-2 (ultimate load)	487
75-2 (75% ultimate load)	365.25
50-2 (50% ultimate load)	243.5

III. RESULTS AND DISCUSSION

From experimental investigation the column specimen tested under different percentage of ultimate load and strengthened using ferrocement and retested to find its ultimate load carrying capacity.

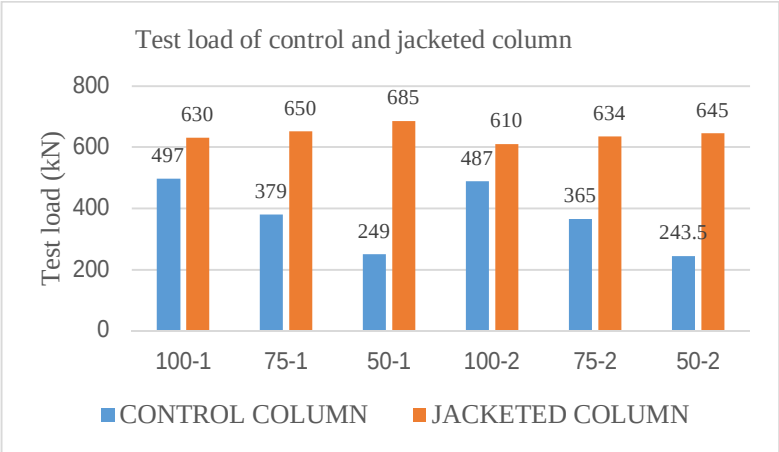

Fig. 4 Test load (kN) for control and jacketed column specimen

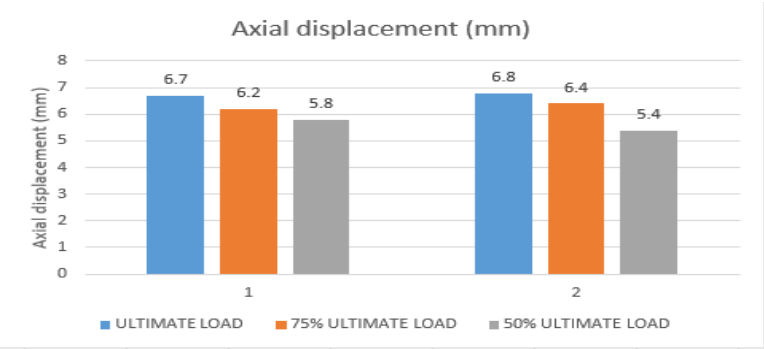

Fig. 5 Axial displacement (mm) for non-jacketed column

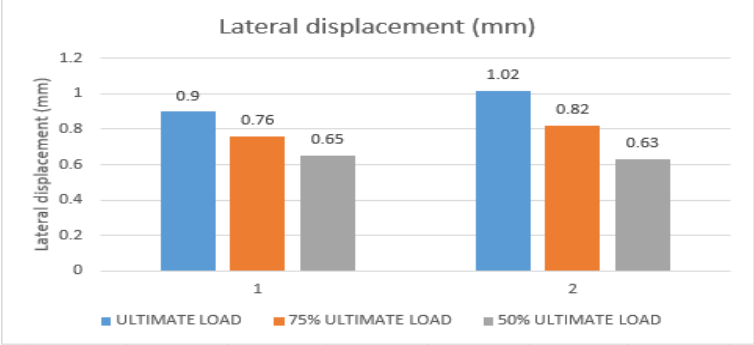

Fig. 6 Lateral displacement (mm) for non-jacketed column

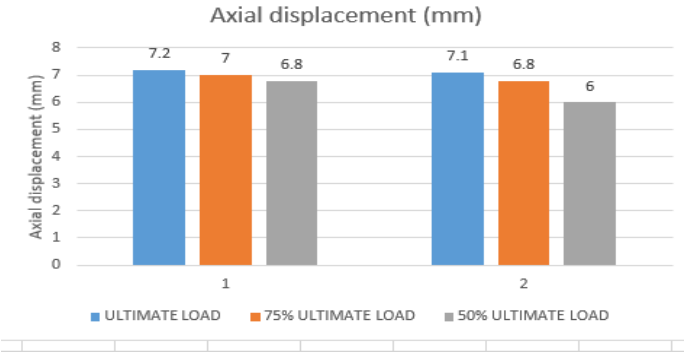

Fig. 7 Axial displacement (mm) for jacketed column

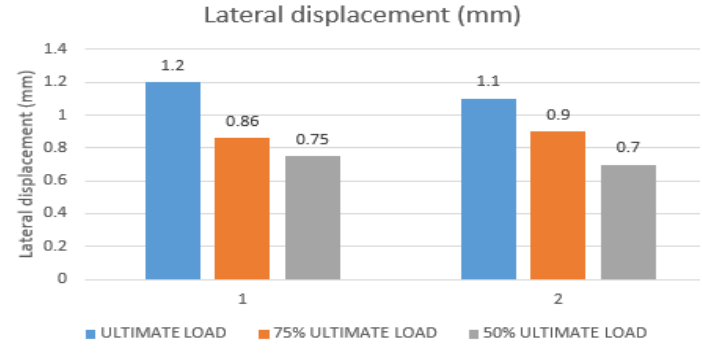

Fig. 8 Lateral displacement (mm) for jacketed column

IV. CONCLUSION

From above experimental work it was concluded that:

1) Ferrocement jacketing technique used effectively for strengthening of RCC column to increase its load carrying capacity.

2) Jacketed column specimen shows 26%, 31% and 37% load increment as compared to non-jacketed column for group-1 and 25%, 30% and 33% for group-2 respectively.

3) Square ferrocement jacketing technique used effectively for strengthening of column.

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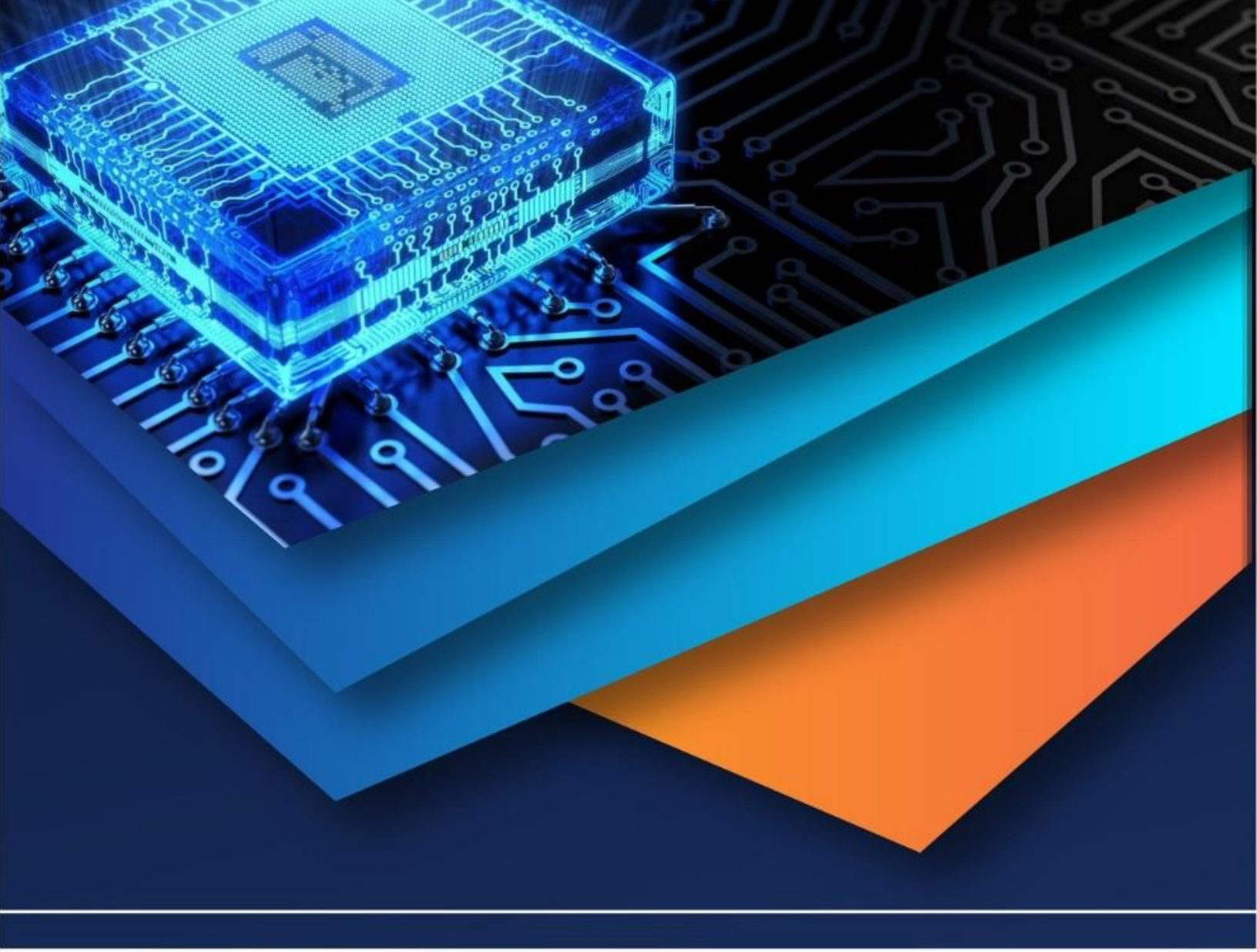

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