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Experimental Study of Axially Loaded RCC Columns Strengthened with Basalt Fabric

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Abstract: ***Strengthening is needed in structural elements, due to many reasons like poor construction, designing errors etc. In these days, building or structure is most important thing but it is not a mobile device that we can demolish it and then reproduce it. So strengthening is the best option to bring back the strength of the building. RCC and Steel Jacketing, FRP wrapping are the most used techniques for strengthening purpose. Steel- fibers, carbon- fibers and Glass- fibers are the most used materials in market and industry, but it is very costly. So it is needed to develop alternative. Here, newly introduced material basalt- fiber is used for that work. In this thesis, axial strength increament is checked by wrapping of basalt fabric. Cubes and Columns of different sizes are casted and tested in this thesis. So that by all the results and conclusions, it can be proved that strengthening and economical point is done with the basalt fiber so that it can be used as alternative of carbon fiber and glass fiber.***

Keywords: Basalt fabric, Epoxy, RC concrete

I. INTRODUCTION

Many older structures today are in the need of strengthening because of many factors & reasons. As a human body aged in the same way building or any structure is also aged in its whole life. The strength of any structure is gradually decreased with the time span. Now-a-days, repair and retrofit of existing reinforced concrete structures such as buildings, bridges, historical places etc., have been the big problem in Civil Engineering. There are many reasons for damages & deterioration of the structure like environmental factors, chemical surrounding environment, poor construction practice, insufficient designs, improper transverse reinforcements, natural calamity, damages due to earthquake etc. The deteriorated structure neither provides serviceability nor be able to take load for which it is designed. Now, Building or structure is not a mobile device that, we can demolish it & buy a new one or construct a new structure. So retrofitting & strengthening of the building is the only good option and very necessary for use the structure which fulfils its all safety and serviceability criteria. Sometimes the load is not calculated in the design, faulty design, and corrosion effect, physical and chemical weathering and there may be de bonding cover of the reinforced structures. In this case the structure undergoes deformation and cracks generates in structural elements. So, in these cases urgently requires of strengthening of structure to achieve its design capacity.

II. LITERATURE REVIEW

A. With the wrapping of FRP materials, it is clearly shown that load carrying capacity of structural element is increased.
B. By applying FRP sheets on elements, there is increase in strength from 30% to 160%.
C. Different layers and configuration of FRP materials affect the results.
D. Various shapes and sizes of the members also affect the results. FRP confinement was very good alternative for strengthening of circular and square RC columns.
E. Carbon fiber gives better results than glass fiber, but main disadvantage is its price.

III. OBJECTIVES OF WORK

A. To study the behavior of RCC Axial members under static loading.
B. To check the Axial strength of RC column with different sizes wrapped with basalt fabric.
C. To examine the enhancement of axial strength by different number of FRP layer like single layer, double layer, partial wrap etc.
D. To check the linear displacement of RC column using LVDT & derive load –axial deformation relation.

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IV. MATERIALS

Concrete is mixture of cement, fine aggregate, coarse aggregate, water and admixtures (if required). Here in this study fibre reinforced concrete is used so, in concrete fibres are also added for better strength. So, for this study Recron 3s polyester fibres are used in different volume fraction (0%, 0.1%, 0.2%, and 0.3%). Also some pozzolanic material (Ground Granulated Blast Furnace Slag and Silica Fume) are used as replacement of cement in different percentages (0%, 10%, 20%, 30%). So, for this study cement, fine aggregate, coarse aggregate, fibres (Recron 3s polyester fibre) and pozzolanic (Ground Granulated Blast Furnace Slag and Silica Fume) materials are used.

V. METHODOLOGY

A. Mix Design

As per IS 456 prepare a mix design of M25 grade of concrete.

B. Mixing And Casting Of Column & Cubes

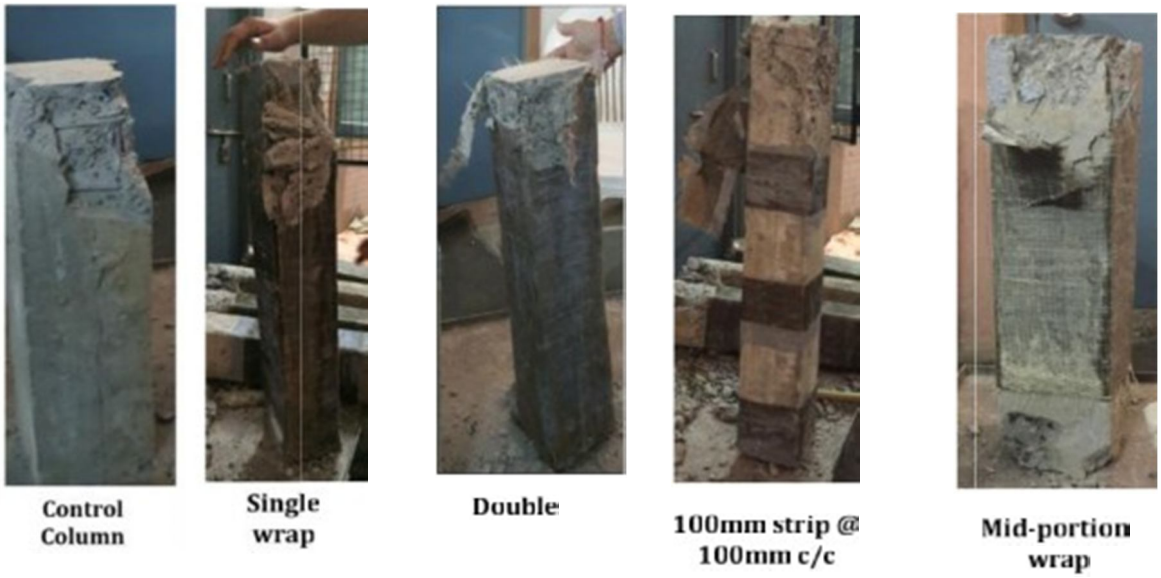
Mixing of the ingredients is done with mixer machine & after the mixing, concrete is placed into the formwork & then compacted with steel rod by hand. At last surface is levelled for better finishing. First of all, the moulds were lubricated with the oil in inner surface. Then steel cage is kept in the mould with proper cover arrangement in all sides. Then concrete is placed in the mould step by step and compaction is done with the steel rod with hand blows. After proper compaction, the surfaces are levelled. After the 24 hours columns were unmolded. Same procedure adopt with the casting of cubes.

C. Curing

After casting work is over moulded specimens are stored in room temperature for 24 hours. After this period specimens are taken out from mould carefully without damaging the surface and immersed in water for 28 days.

D. Testing

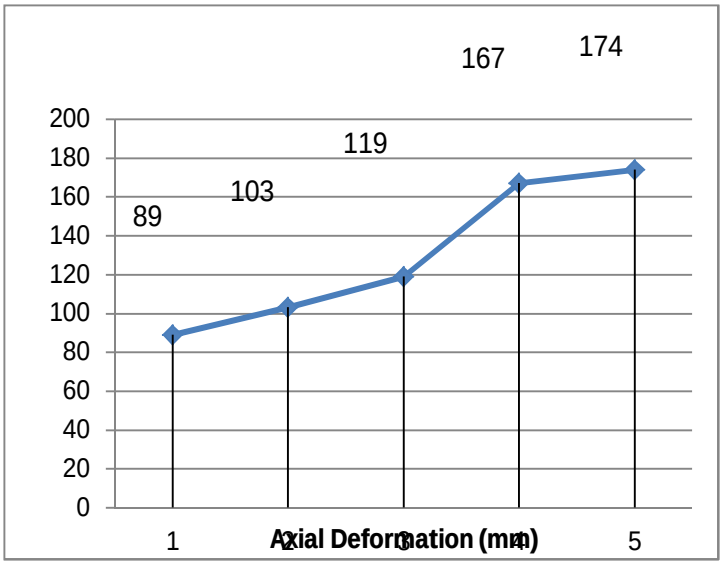
In this experiment, different sizes of the axial members were casted. The column were tested in 100tonne capacity of Universal Testing Machine (UTM). Here, Axial compressive load was given to the columns. Also one strain gauge was fixed on the face of the column to check the axial displacement.



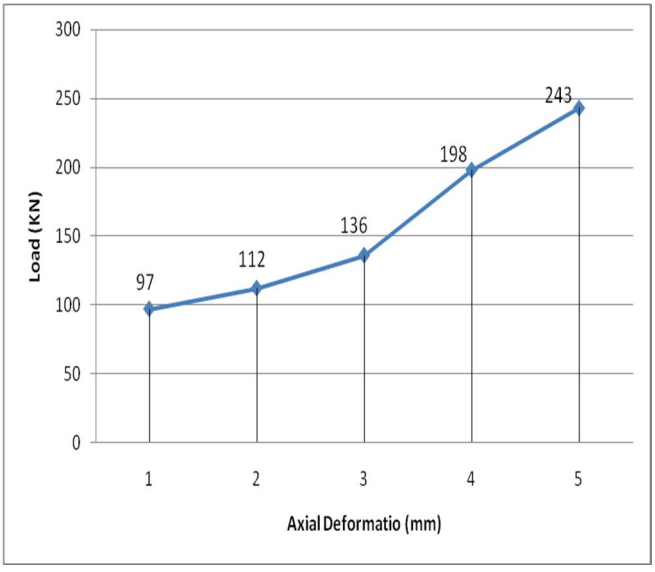
Results of 900mm length of column:

Axial Deformation	Load				
Mm	KN				
	CCX	CW_1X	CW_2X	CW_3X	CW_4X
1	89	97	107	92	104
2	103	112	191	108	133
3	119	136	276	159	169
4	167	198	313	181	192
5	174	243	371	202	221
Final Load	182	272	393	226	258

Load v/s Axial Deformation curve for CCX :



Load v/s Axial Deformation curve for CW_1X



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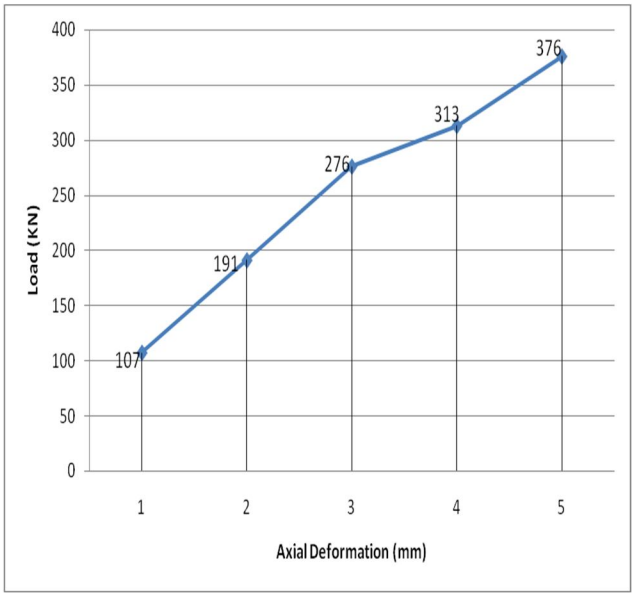
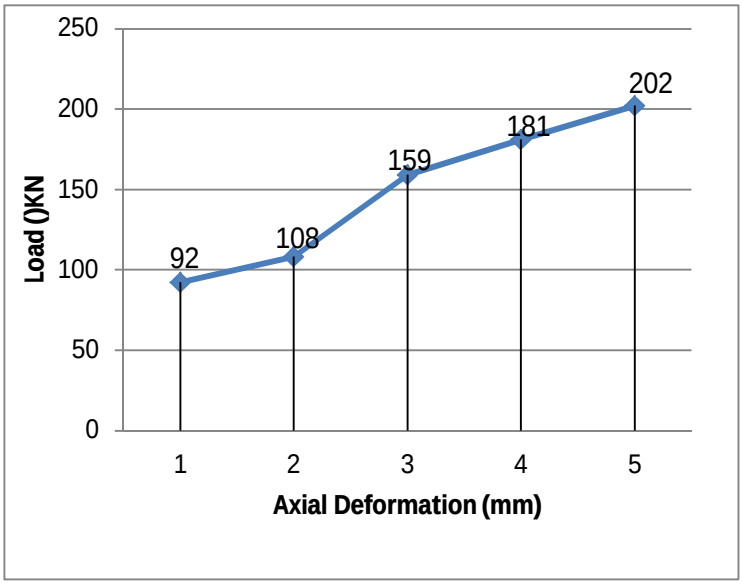
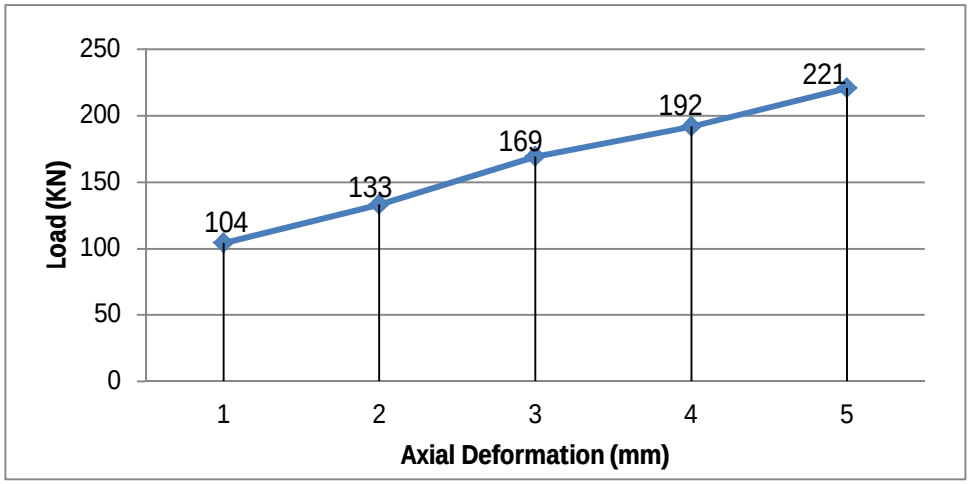
Load v/s Axial Deformation curve for CW_2X



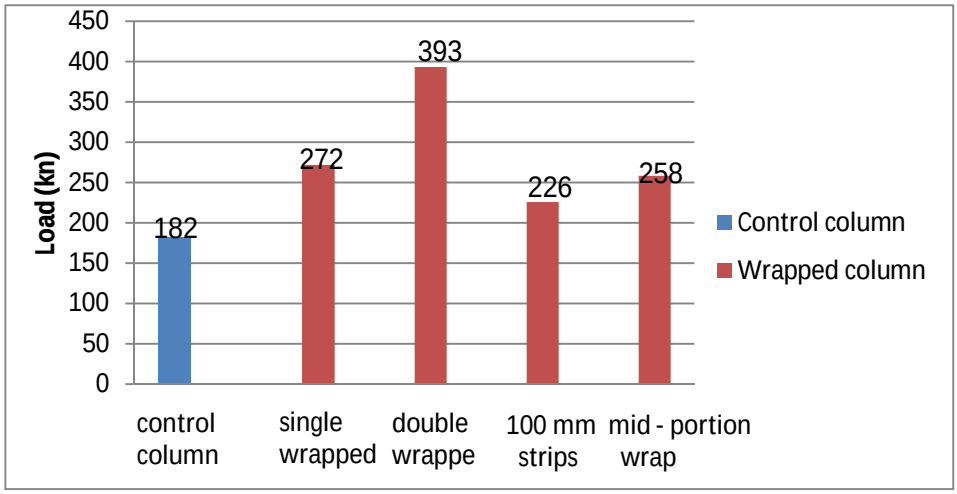
Load v/s Axial Deformation curve for CW_3X



Load v/s Axial Deformation curve for CW_4X



Comparison of Ultimate Load carrying capacity of 900 mm length column (X) :



The Ultimate load carrying capacity of X column increased as compared to its control column…..

1) 50% for single wrap
2) 116% for double wrap,
3) 24% for 100mm strip wrap
4) 42% for mid portion wrap

VI. CONCLUSIONS

A. This experimental results clearly demonstrate the Basalt fabric wrapping can enhance the structural performance of RC column unde raxial loading by providing additional confinement to concrete without increasing original size of the column.
B. Ultimate load carrying capacity of Z (900mm) column increased as 50 single wrap, 116% for double wrap, 25% for 100mm strip wrap & 42% for mid portion wrap compared to its control column.
C. With Increasing wrapping of basalt fabric, the axial load of carrying capacity of column is also increase.
D. Also the strengthening effect is increase with more no. of wrapping basalt fabric.
E. Debonding of the FRP material was not sudden, it may give some warning before failure like cracking sound.
F. Vertical displacement is also less in wrapped column compared with the control column.

VII. ACKNOWLEDGMENT

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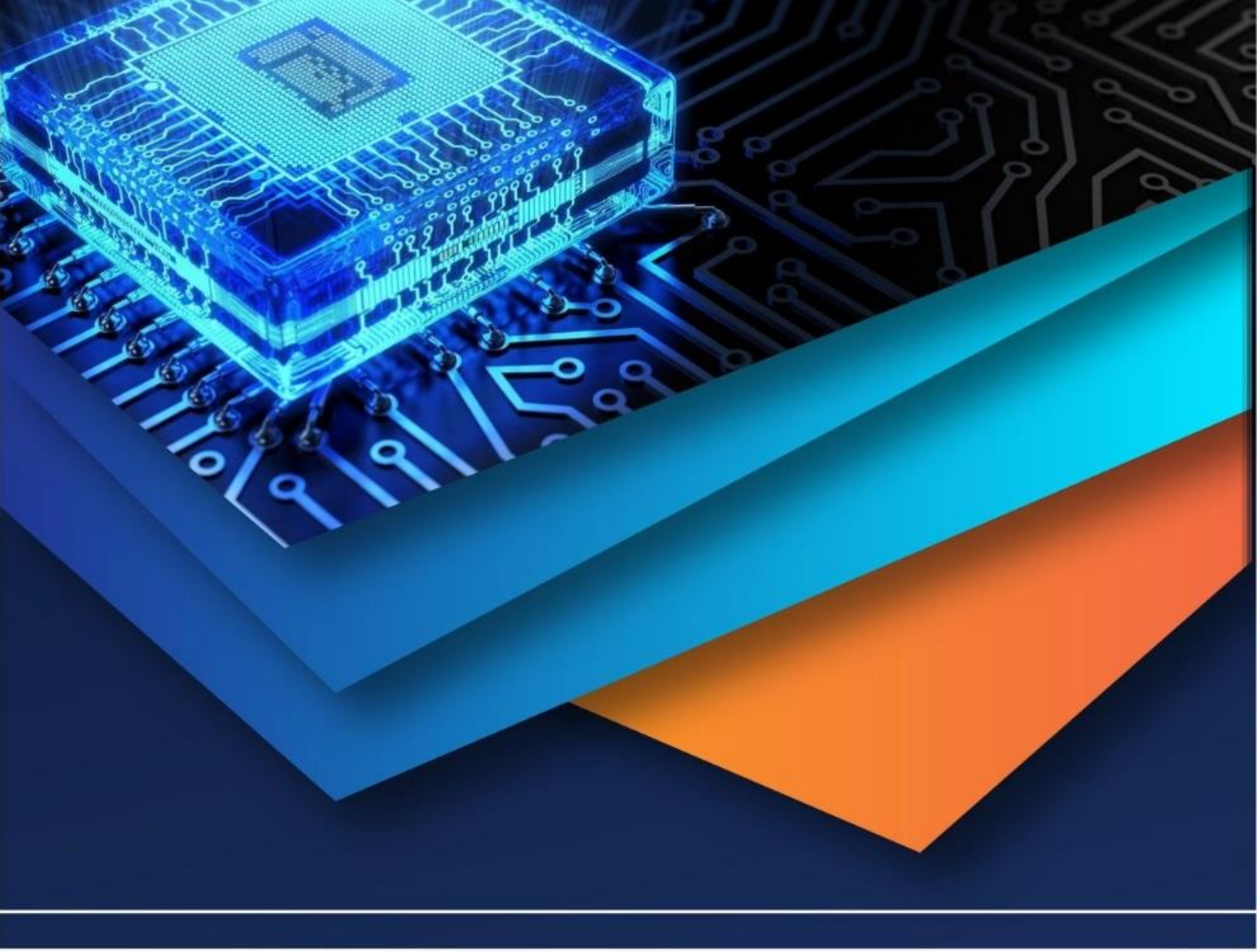

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