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EXPERIMENTAL STUDY ON EFFECT OF FERROCEMENT JACKETING ON THE PERFORMANCE OF COLUMNS WITH PLAIN SURFACE AND A GENTLE WAVE TYPE CONFIGURATION (PSWC) BARS

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Abstract- The work focused on performance of RCC column depend by longitudinal reinforcement and ferrocement under various static axial load. RCC column specimens were depend on vertical steel reinforcement wrapping by various amount of ferro mesh and then covering with cement mortar. The various results shown significantly improvement of the strength and ductility of the strengthening column by reference of column without strengthening. Ductility ofsteel is also significantly improving by the increasing of the total volume of ferro mesh. Comparative study is carried out with column jacketing with PSWC bars and retrofitting with ferrocement jacketing. The use of PSWC-bars, characterized by their plain surface and a gentle wave-type configuration, can enhance the life span of concrete structures several fold through minimization of the rate of corrosion in rebars. This present study is aimed to check the load carrying capacity containing PSWC bars and retrofitted with ferrocement jacketing.

Keywords— Retrofitting, Ferrocement Jacketing, PSWC Bars, RC Column

I. INTRODUCTION

The For thousands of years, humans have taken advantage of ductile materials with high tensile strength in the reinforcement of brittle materials with high compressive strength. The ductile reinforcement transfers tensile loads in the structure, allowing the brittle material to crack without causing failure of the structure. Throughout the last two centuries, concrete has been developed into a construction material with ever increasing potential to support compressive forces. As the compressive capacity of concrete has increased and with it demands to support longer and larger and taller structures, stronger, more ductile and more tensile reinforcement has been required.

As a solution to the problem, we offered PSWC-bars with ferrocement jacketing, characterized by their plain surface and a gentle wave-type configuration. The maximum excursion of the axis of a PSWC-bar from its original straight line configuration is only a few millimetres, say e.g. 5mm.

The wave-type configuration, in the absence of ribs, permits the use of rebars of high strength steel. PSWC-bars of the wave shape can be made easily by using a pair of gear rollers at the last stage of the rolling mill stand. This is the hot forming process. PSWC-bars can also be cold-formed. PSWC-bars can be made of any grade of steel, which would be suitable for conventional rebar's. PSWC-bars do not require any special treatment for their effectiveness in enhancing the life span of reinforced concrete constructions, increasing load carrying capacities and transforming brittle concrete structures into ductile ones. The maximum excursion of the axis of a PSWC-bar from its original straight line configuration is only a few millimeters, say e.g. 5mm. PSWC-bars do not require any special treatment for their effectiveness in enhancing the life span of reinforced concrete constructions, increasing load carrying capacities and transforming brittle concrete structures into ductile ones.

Ferrocement can be effective strengthening tools for RC columns. Manufacturing of Ferrocement is very easy and needs no advanced techniques. Low material cost, special fire and corrosion protection features makes it an ideal means of jacketing in developing countries. Normally Portland cement and fine aggregate matrix is used in ferrocement. The ferro cement possess high resistance against cracking, high fatigue resistance higher toughness and higher impermeability.

II. AIM AND OBJECTIVES

The aim of the work is to carry out "Experimental study on Effect of Ferrocement Jacketing on the Performance of the Column with Plain surface and a gentle wave type configuration (PSWC) bars".

Objective :

The main objective of present work is as follows:

- To check the performance of column having PSWC-bars when Jacketing.
- To study the Compressive strength of columns having different grades of concrete with PSWC-bars.
- Performance of PSWC-bars as compare to plain round bars.

III. MATERIALS

Cement
Grade 53 Ordinary Portland cement (OPC) was used in concrete mixes for casting of test specimen and ferro cement jacketing. The specific gravity of cement is 3.15.

Aggregate
The coarse aggregate of two grades are used one retained on 10mm size sieve and another grade contained aggregate retained on 20mm sieve size. The maximum size of coarse aggregate was 20mm and is having specific gravity of 2.85 grading confirming to IS: 383-16970

Reinforcement
12mm dia HYSD steel bars, 12mm dia PSWC bars and 12mm normal plain bar for main steel and 8mm are used for stirrups for casting of column.

Ferro mesh
Ferrocement is a type of thin wall reinforced concrete commonly constructed by hydraulic cement mortar reinforced with closer spaced layers of continuous and relatively small size wire mesh. The mesh may be made of metallic or other suitable materials.

PSWC-bars
PSWC-bars do not require any special treatment for their effectiveness in enhancing the life span of reinforced concrete constructions, increasing load carrying capacities and transforming brittle concrete structures into ductile ones. PSWC-bars, characterized by their plain surface and a gentle wave-type configuration as shown in Figure 1. The maximum excursion of the axis of a PSWC-bar from its original straight line configuration is only a few millimeters, say e.g. 5mm.

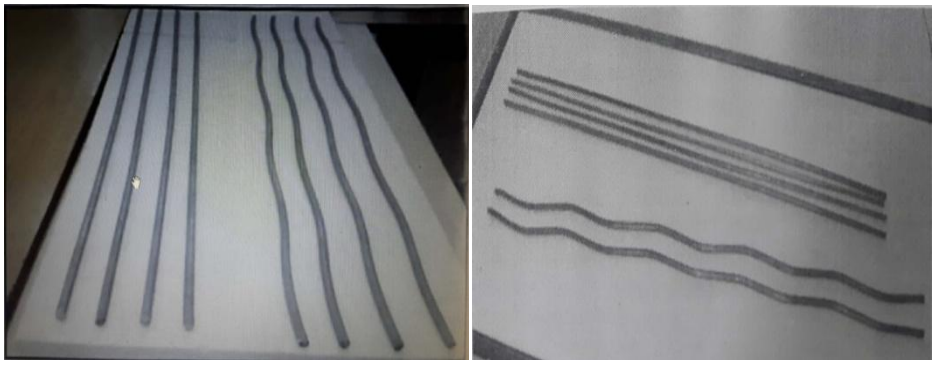

Figure 1. 12mm Conventional plain bars and PSWC-bars

Iv. METHODOLOGY

4.1 CASTING PROCEDURE:
Casting of the column size 150X150X1000MM starting with12 specimen as control specimen of three column M-20 and three M-25 grade of concrete for HYSD bars similarly six columns for with ferrocement jacketing. Than other 24 column similarly casted for Conventional Plain bar and PSWC bars with ferrocement and without ferrocement jacketing and then cured for 28 days.

ITEM	M-20 Without Jacketing	M-25 Without Jacketing	M-20 Without Jacketing	M-25 Without Jacketing
HYSD Bars	3	3	3	3
Plain Round Bars	3	3	3	3
PSWC Bars	3	3	3	3

4.2 PREPARING CONCRETE:
Batch mixer was used. Firstly all the materials weighted on weighing scale as per quantity of mix design. Then course aggregate, fine aggregate, cement are mixed with ½ of the mix water for some time until proper mix, then add another ½ water and run batch mixture for proper mix in batch.

Figure 2&3 Casting of Column specimen (size 150 X 150 X 1000MM)

For Axial Load, tests were conducted on 150x150x1000 mm Column Moulds, after 28 days of proper curing. 36 Column casted as controlled specimen and tested for each combination.

V. RESULT AND DISCUSSION

for testing of Column Loading frame is used, the load is applied for first crack load and ultimate load for control specimen.

Figure 4&5 Testing Setup of Loading Frame

Figure 6 applying cement mortar of (1:3) on Ferro mesh

Figure 7 applying cement mortar of (1:3) on Ferro mesh

VI. TESTING RESULTS

The Failure Load of all the non jacketed columns were tested and then the columns were jacketed with ferrocement with 1:3 ratio of cement, sand and wire mesh. After curing the jacketed columns for 14 days and then the failure load of the jacketed columns were tested accordingly.

Table 3 Test result of M20 and M25 grade of non-jacketed and jacketed column

Column Description	Axial Load in KN for M-20	Axial Load in KN for M-25	Increasing Load after retrofitting for M-20	increasing Load after retrofitting for M-25
Control Specimen (HYSD bars)	450	575	475	610
Plain Surface Round bars	440	570	460	600
PSWC bars	460	590	485	640

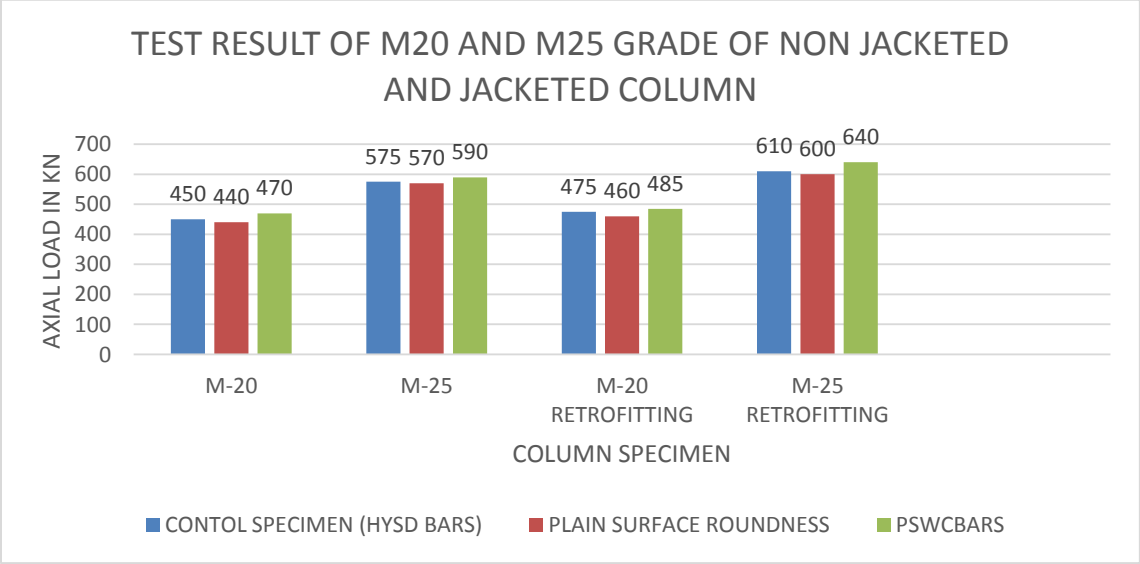

Figure 8 Test result of M20 and M25 grade of non-jacketed and jacketed column

Table 3 Percentage increase result of M20 and M25 grade for non-jacketed and jacketed column of Plain surface and PSWC-bars with compare to HYSD bars

Column Description	% increase M-20	% increase M-25	% increase after retrofitting for M-20	increase after retrofitting for M-25
Plain Surface Round bars	-2.22 %	-0.87 %	-3.16 %	-1.64 %
PSWC bars	4.44 %	2.63 %	2.11 %	4.92 %

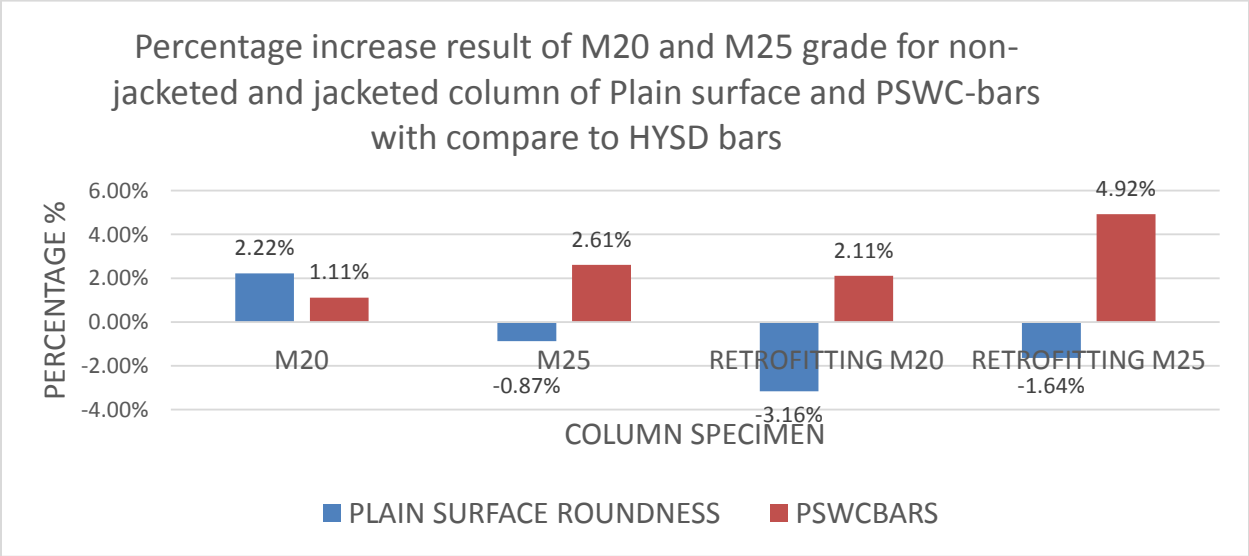

Figure 9 Percentage increase result of M20 and M25 grade for non-jacketed and jacketed column of Plain surface and PSWC-bars with compare to HYSD bars

Table 3 Percentage increase result of M20 and M25 grade of jacketed column

Column Description	% increase after retrofitting for M-20	% increase after retrofitting for M-25
Control Specimen (HYSD bars) with Jacketing	5.56 %	6.09 %
Plian Surface Round bars with Jacketing	4.55 %	5.26 %
PSWC bars with Jacketing	3.19 %	8.47 %

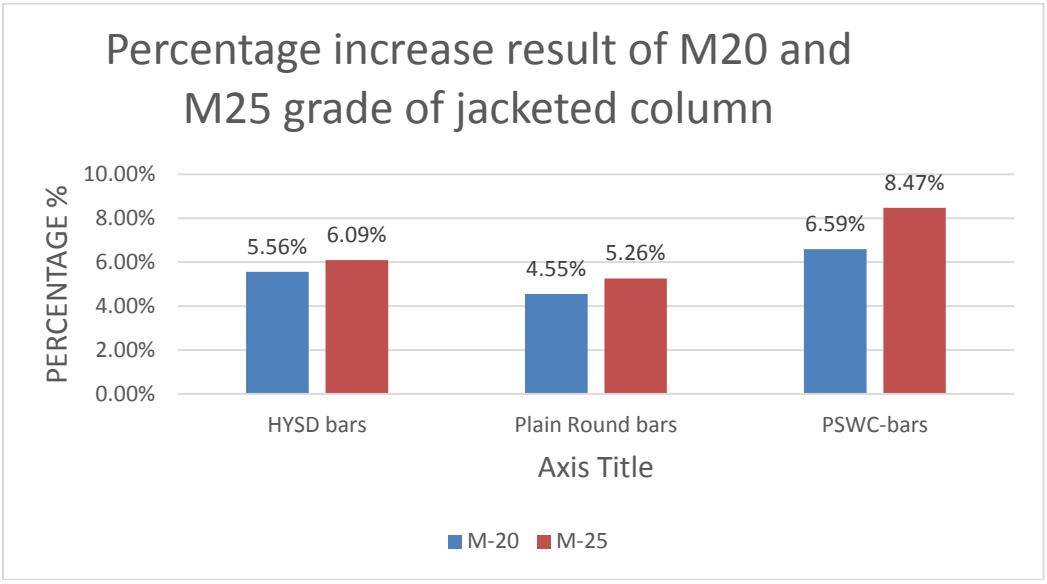

Figure 10 Percentage increase result of M20 and M25 grade of Jacketed column

Clearly it's shown in results as PSWC bars with ferrocement jacketing gives the better strength as compare to normal HYSD bars. Ferro mesh as the number of layer is increase the strength of specimen also increase.

I. CONCLUSION

- In RCC Columns axial load carrying capacity is increase.
- The load carrying capacity of PSWC-bars is more than normal specimen as compared in M-20 and M-25 grade of concrete respectively.
- The percentage strength increase for PSWC bars was more than the normal specimen hence the PSWC bars proved to be a good option for retrofitting of columns.
- There is increase in compressive strength of column by 6.59% & 8.47% respectively in M-20 & M-25 concrete with the use of ferrocement jacketing.

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