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COMPARATIVE STUDY ON SHEAR STRENGTHNING OF RCC BEAMS USING FERROCEMENT AND ARAMID FIBER

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Abstract- In this paper an experimental study is presented which details the difference in strength of aramid fibre polymer reinforced and ferrocement jacketing. For this study, Fourty two beams of cross section 300x120mm and overall length of 700mm are casted. 06 beams were served as control beams. Shear test was carried out under UTM. three wrapping pattern were adopted for the experiment work i.e. Single Layer, Double Layer, 80mm strip of aramid fibre, Single layer of ferrocement wire mesh and aramid fibre sheet and Double layer of ferrocement mesh and aramid fibre sheet..

Keywords— retrofitting, fibre reinforced polymer, aramid fibre, ferrocement jacketing, shear strengthning.

I. INTRODUCTION

The term repair is defined as modifying existing structure with additional or by using very new component. RCC concrete is one of the most used construction materials, only in the developed world, but also in the small parts in the developed world. The RCC structures in the developed world are very less found to sustain distress and suffer damage, even before their life period is over due to different types causes such faulty design, faulty construction, usage of building, change code provision, overloading, explosion, corrosion etc. the retrofitting of the structure in development has that the use of natural and artificial fibers have many advantages such as high density, higher toughness, good thermal properties. There are various types of fibers are available in the market but aramid fibre gives the better strength compare to other fiber. Cost of fabrication is also low for these type fibers. The attempt has been made to use aramid fiber and ferrocement jacketing for strengthning of beams for the research work.

II. OBJECTIVES

The following objectives are of this experimental study:

- To find the suitable material for shear strengthning by testing all the beams for ultimate load carrying capacity by each beam specimen.
- To find the better strength fibre materials for providing flexibility in the retrofitted beams specimen by finding deflection suffered by beams during load applied and check the deflection.
- To study the shear strength of RC deep beams with ferrocement jacketing and aramid fiber
- Compare the test result of different layers used in deep beams retrofitted with ferrocement and aramid fiber.
- To investigate failure pattern of beams under different loading conditions.

III. MATERIALS

Cement

Ordinary Portland cement of 53 grade manufactured by ultratech cement company was used in concrete mixes. 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

HYSD 415 steel bars of 12mm and 8mm are used for design of beams. 10mm bars used as longitudinal bars for tension and 8mm bars are used for stirrups.

Aramid Fiber

Aramid fiber is very good synthetic fiber characterized by strength five times stronger than steel on equal weight basis and heat resistant some more than 500 degrees Celsius. It is useful in various applications such as composites, aerospace, automotive, protective, and clothing that is in heat radiation chemicals.

Ferro mesh

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

Table 1 Physical properties of aramid fibre sheet

ITEM	DATA	UNIT
Width	1	m
Breaking Strength	0.3	N/mm^2
Elongation	3.40	%

Table 2 Physical properties of Ferro mesh sheet

ITEM	DATA	UNIT
Diameter	12	mm
Tensile Strength	450	N/mm^2
Yield strength	250.5	N/mm^2

Iv. CASTING PROCEDURE

For 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 1 casting of beam specimen

For shear strength, tests were conducted on 300x120x700 mm beam Moulds, after 28 days of proper curing. 6 beams casted as controlled specimen and tested for each combination.

V. TESTING OF BEAM

for testing of beam UTM is used, the load is applied for first crack load and ultimate load for control specimen. After the first crack for all the beams they are retrofitted with different pattern for ferrocement jacketing and aramid fiber sheet with the help resin of (1:2) ratio.

Figure 2 Testing Setup of UTM

Figure 3 single layer of aramid fiber

figure 4 80mm strip wrapping of aramid fiber

Figure 5 setup for two point load system

Figure 6 Ferro mesh jacketing of single layer

figure 7 80mm strip Ferro mesh

Figure 8 applying cement mortar of (1:3) on Ferro mesh

VI. Testing Results

Table 3 Test result of M20 grade of beam with aramid fibre

Beam Description	Ultimate Load KN	% increase after retrofitting
Control Specimen	73.00	0
Single layer	102.38	40.24
Double layer	151.0	47.48
80mm strip	96.35	36.19

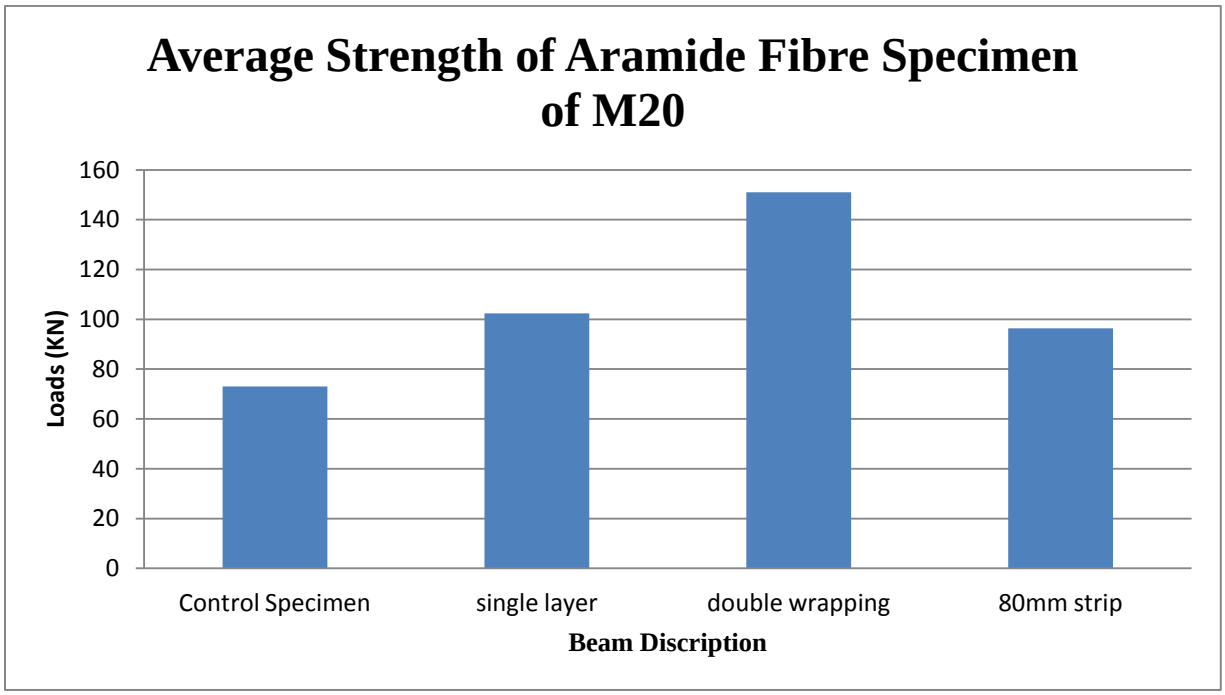

Figure 9 Test result of M-20 for aramid fibre

Table 4 Test result of M25 grade of beam with aramid fibre

Beam Description	Ultimate Load KN	% increase after retrofitting
Control Specimen	103.30	0
Single layer	154.20	49.20
Double layer	235.50	52.72
80mm strip	141.20	40.01

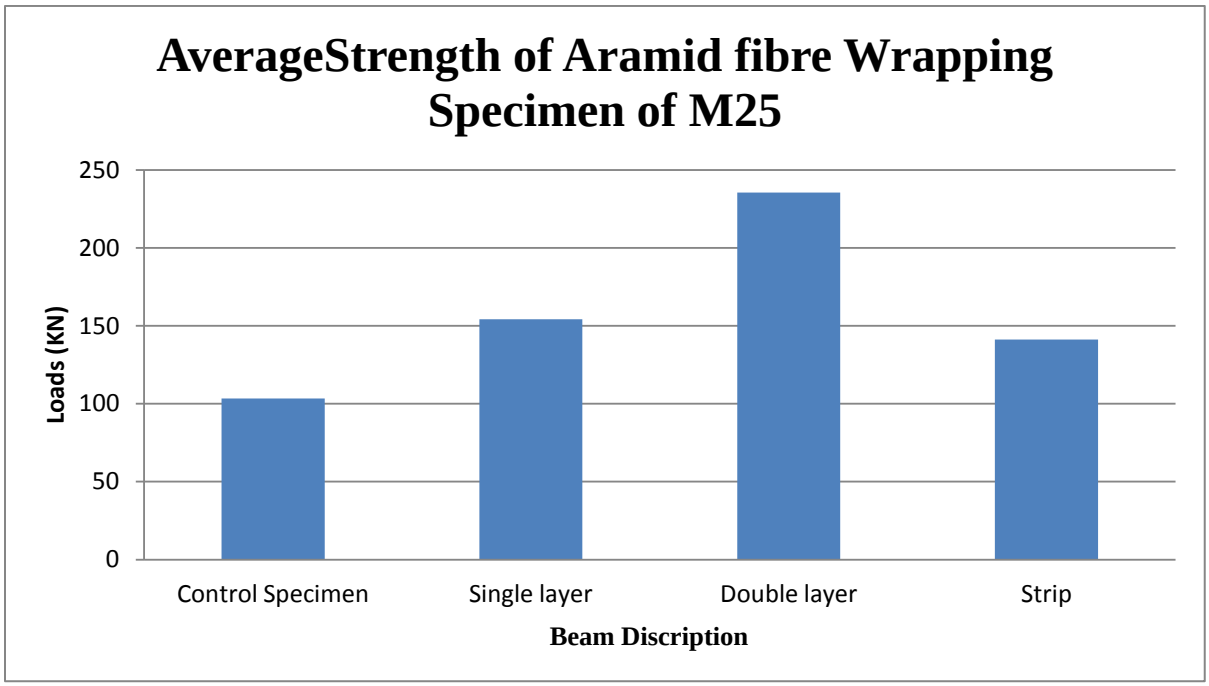

Figure 10 Test result of M-25 for aramid fibre

Table 6 Test result of M20 grade ferrocement jacketing

Beam Description	Ultimate Load KN	% increase after retrofitting
Control Specimen	73.00	0
Single layer	92.42	26.60
Double layer	119.60	29.40
80mm strip	84.50	24.33

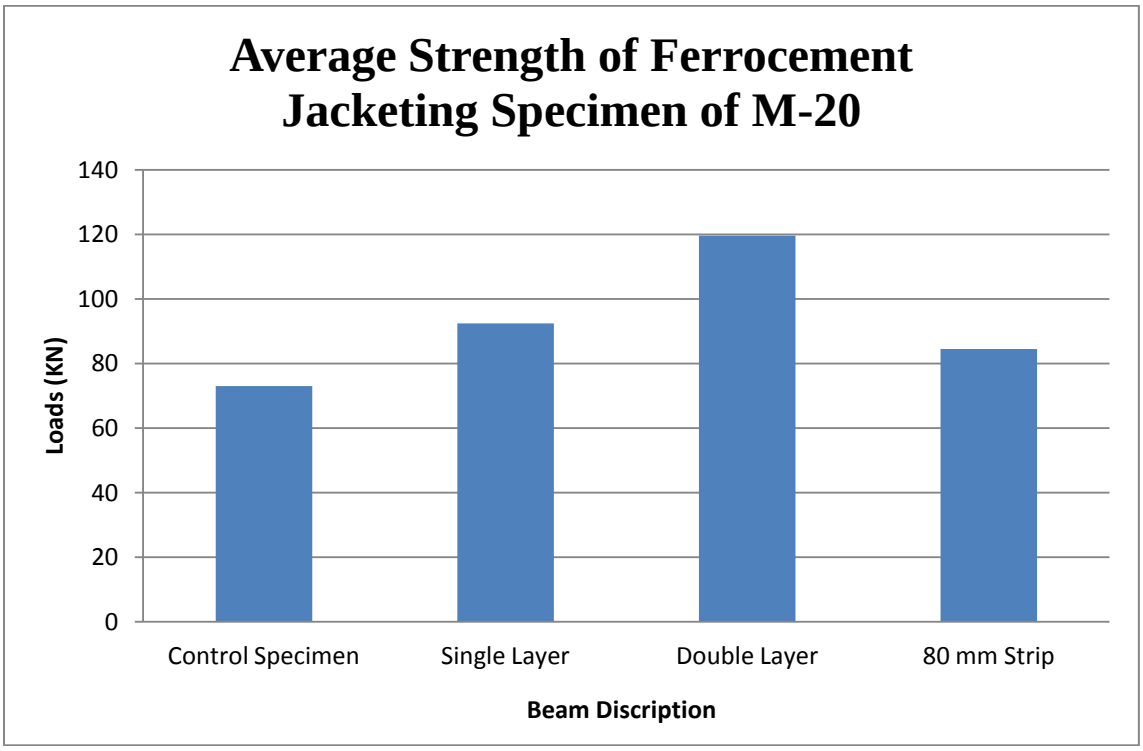

Figure 11 Test result of M-20 for ferrocement jacketing

Table 7 Test result of M25 grade ferrocement jacketing

Beam Description	Ultimate Load KN	% increase after retrofitting
Control Specimen	103.30	0
Single layer	137.50	33.10
Double layer	187.60	36.43
80mm strip	130.00	29.50

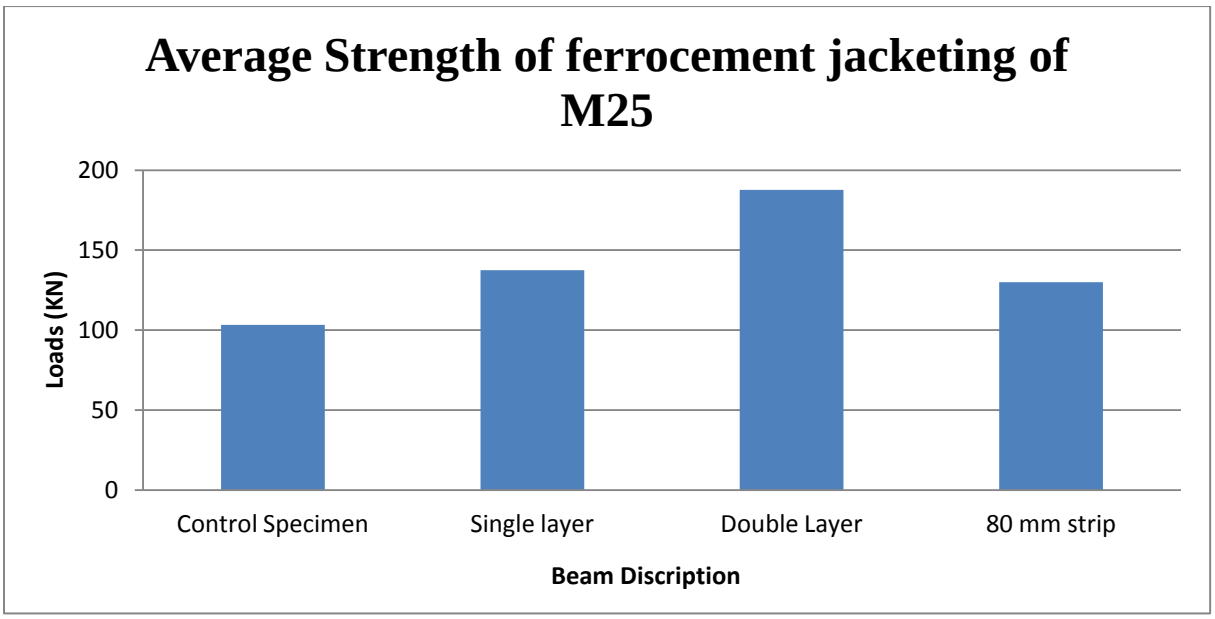

Figure 12 Test result of M-25 for ferrocement jacketing

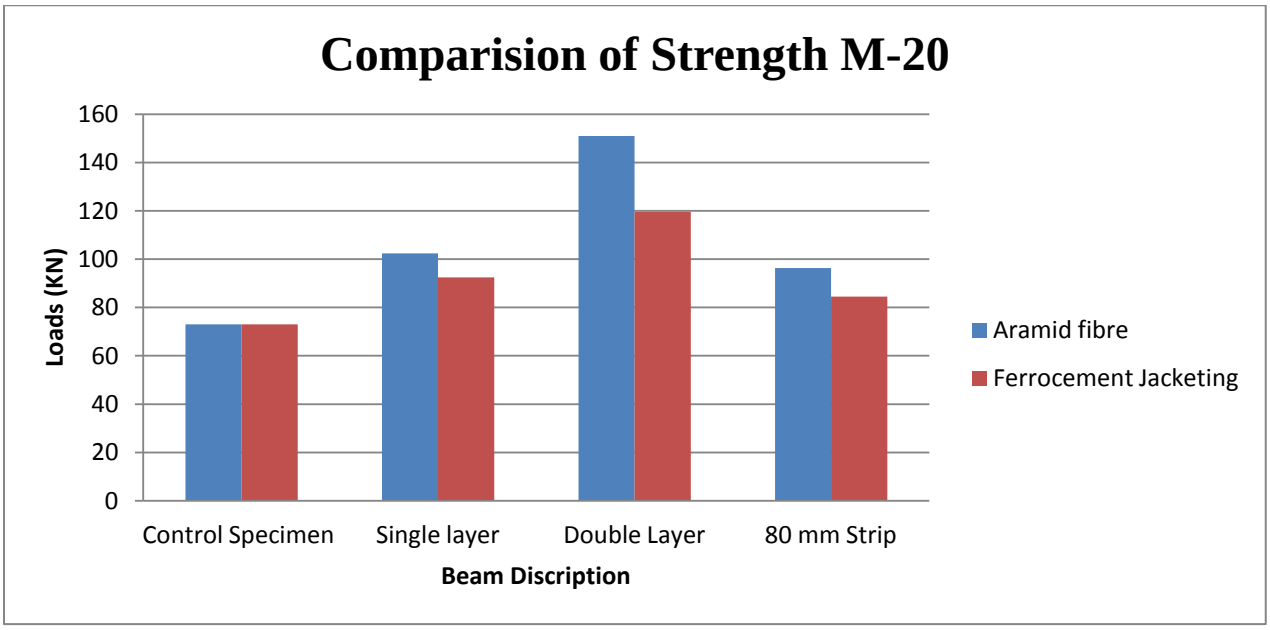

Figure 13 comparisons of Test result of M-20 for aramid fiber and ferrocement jacketing

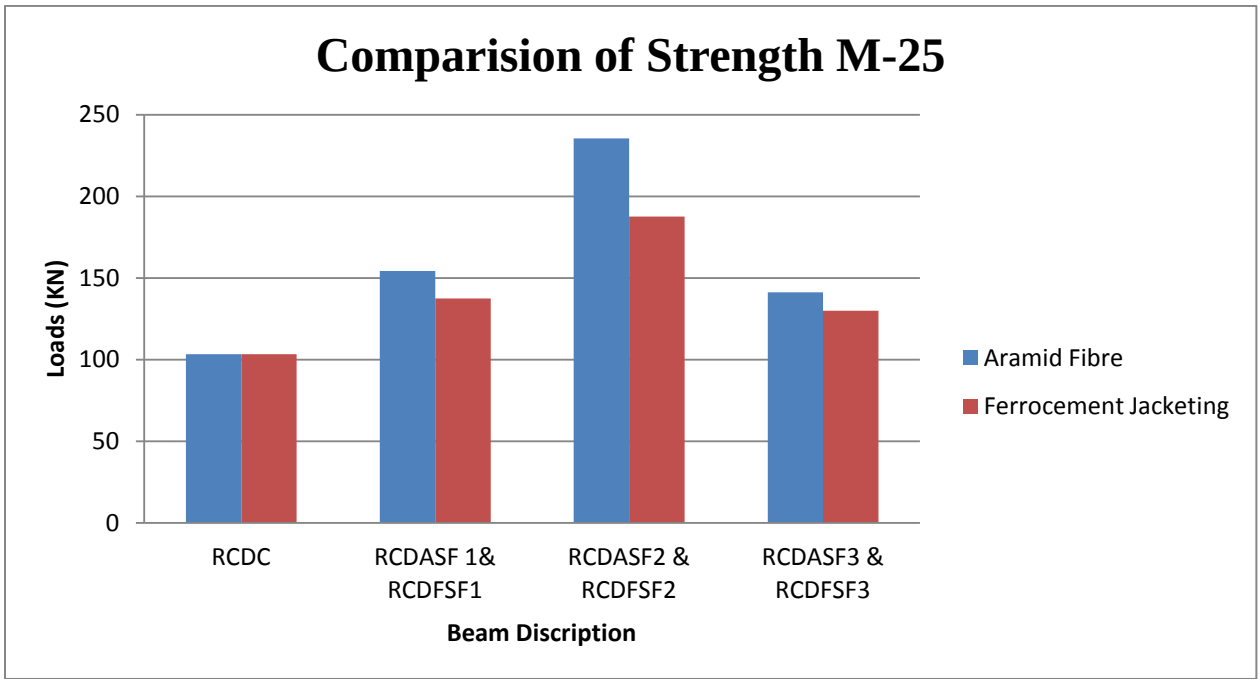

Figure 14 comparisons of Test result of M-25 for aramid fiber and ferrocement jacketing

Clearly it's shown in results as aramid fibre gives the better strength as compare to ferrocement jacketing as the number of layer is increase the strength of specimen also increase. The

I. CONCLUSION

- After this experiment results show that the ferrocement jacketing and aramid fibre sheet are use as retrofitting materials.
- Using aramid fibre sheet for retrofitting results show that the ultimate load carrying capacity are increasing in double layer is 47% to 54% for M-20 and M-25 grade of concrete, compare with control specimen.
- Using ferrocement jacketing for retrofitting results shows that the ultimate load carrying capacity are increasingly in double is 29% to 36% for M-20 and M-25 grade of concrete, compare with control specimen.
- Aramid fibre sheet give a good results in ultimate load carrying capacity compare to ferrocement jacketing.
- Double wrapping of aramid fibre give good ultimate load carrying capacity compare to single wrapping and strip wrapping technique respectively.

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