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STRENGTHENING OF REINFORCED CONCRETE BEAM USING GLASS FIBER REINFORCED POLYMER

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ABSTRACT:
The structural strengthening of the survive reinforced concrete(RC) infrastructure has become important. This is due to stagnation of these structure as a result of ageing, environmental induced degradation, lack of maintenance etc.As a result, fiber reinforced polymer (FRP) is used for retrofitting and buttress these structures.The composite material (FRP) build of a polymer matrix reinforced with fibers Also FRP have excellent performance both in term of bonding and load carrying capacity

KEYWORDS: Fiber Reinforced Polymer (FRP) laminates, retrofitting, loading frame, RC beams, Glass fiber reinforced polymer (GFRP)

1. INTRODUCTION

The structural strengthening of the existing reinforced concrete(RC) infrastructure has become important.This is due to stagnation of these structure as a result of ageing, habitat induced degradation, lack of maintenance etc.As a consequence, fiber reinforced polymer (FRP) is handed-down for retrofitting and strengthening these structures.FRP is a complex material build of a polymer matrix reinforced with fibers Also FRP have excellent performance both in term of bonding and load carrying capacity

2. MATERIALS

Coarse aggregate(CA)
The coarse aggregate from deformed basalt rock confirming IS: 383 having the size of 20mm
Was used .The elongation index and flakiness index was maintained below 15%.

Fine aggregate(FA)
Manufactured sand having a specific gravity of 2.55 is used which satisfies the requirement as per IS: 383(2.5-2.9)

Ordinary Portland cement (OPC)
OPC of 43 grade is used. The specific gravity of cement was 3.15 which satisfies the requirements as per IS 8112-1989(3.10-3.15)

Water
quantity & quality of water is very important in a concrete to achieve its strength .W/C ratio of 0.45 is used for M-20 grade

GFRP
Fiber glass mesh is fabricate by using fiber glass yarn. It is cheap material and also light in weight ,easy to handle .The density of this mesh is 145 GSM(gram per square meter),S.G = 1.99 Improves the surface mechanical strength.High resistance to tearing and stretching

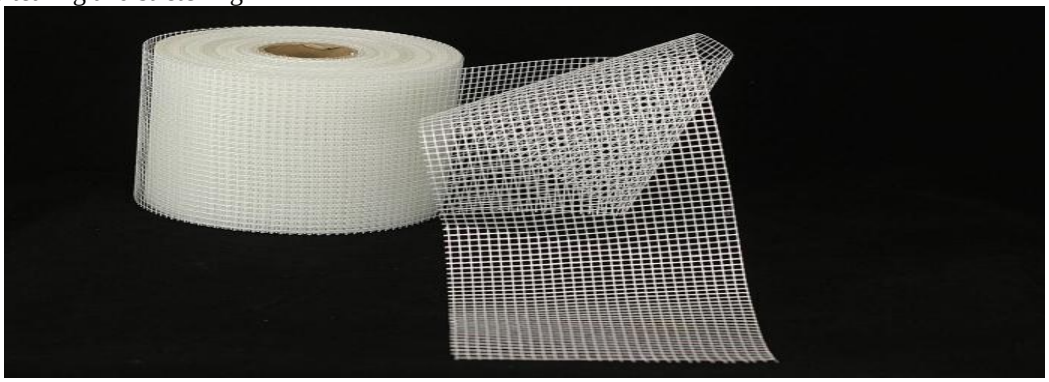


Figure 1 Glass fiber textile mesh

EPOXY RESIN

The epoxy resin of Specific gravity 1.17 is used which satisfies ASTH D-792 requirement

3. MIX DESIGN

As per IS: 10262: 2009 M-20 grade was designed and test sample was prepared

Table 1 Properties and quantities of constituents

CONSTITUENTS	PROPERTIES	QUANTITY (kg/m3)
Cement-OPC 43	Specific gravity=3.15	384
Fine Aggregate-M Sand	Specific gravity=2.55	815
Coarse Aggregate-20mm	Specific gravity=2.51	1075

4. EXPERIMENTAL PROGRAM

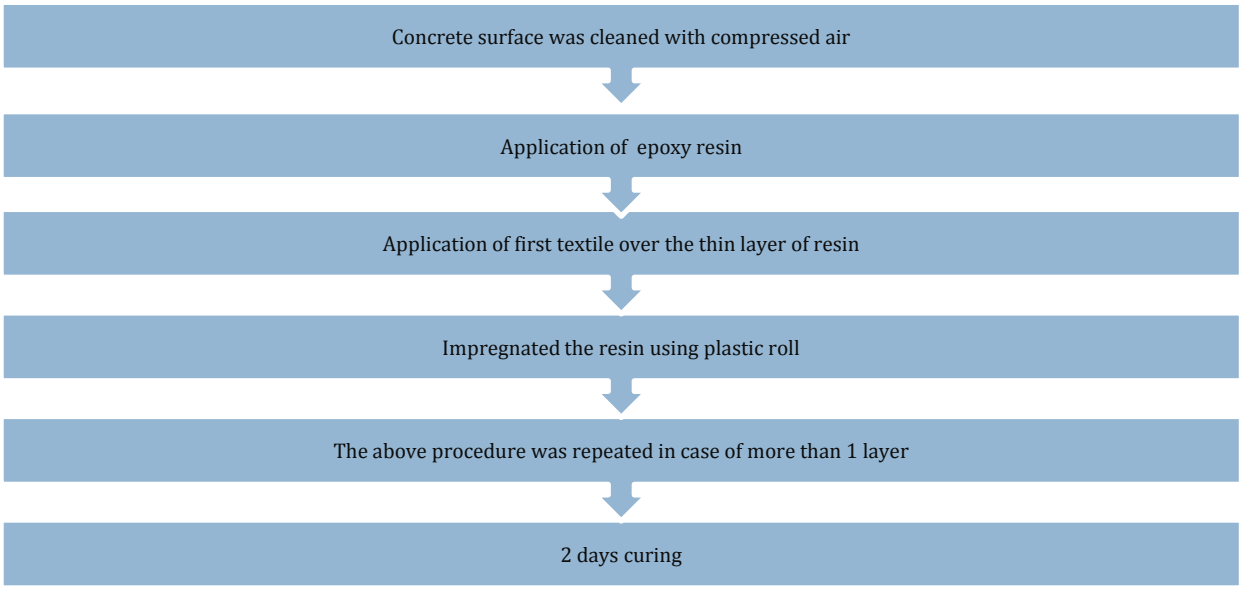
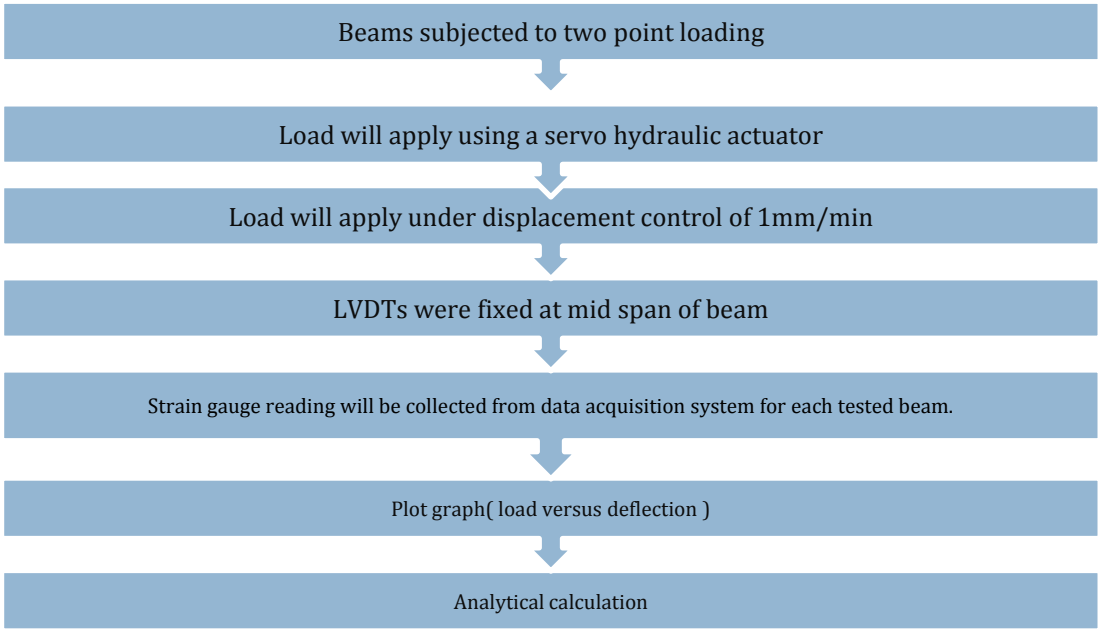


Figure 2 Application of GFRP



4.3. Flexural strength test using loading frame

1100mmX100mmX150mm RC beams(Figure 6) are cast according to M20 grade using OPC- 43 grade, M-sand, and 20mm aggregate according to concrete mix design. Five beams were cast and were subjected to 28 days of water curing. After curing of 28 days the specimens are tested using loading frame. Using 1000mm of an effective span, all the beams were tested.at 666.67mm spacing 2 linked loads were applied and tested.by adopting manually Operated jacks linked to a statistics acquisition arrangement along the load cells the beams were tested. The corresponding deflection with an increase in load is noted by using dial gauges placed at mid span points.

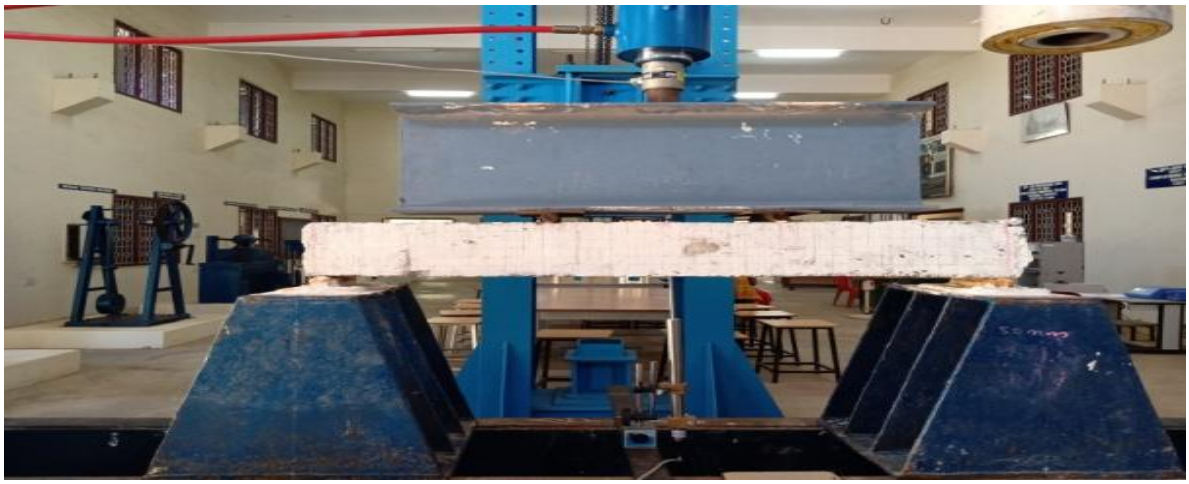


Figure 3 Beam set up

5. RESULTS AND DISCUSSION

Figure 4 mainfest the load v/s deflection graph for control beam, beam using GFRP layer of 1 and 3 nos. It could be grasp that the GFRP layer of 1 nos has shown highest load value of 125kN. Similarly Figure 5 mainfest beam with 5 and 7 layer of GFRP, it could be seen that the 5 layer beam has mainfest highest load value of 130Kn. graph 5(b) shows the comparison of load and deflection in control beam, beam with 1,3,5,7 layer of GFRP. It clearly mainfest that minimum deflection is achieved at the maximum load.

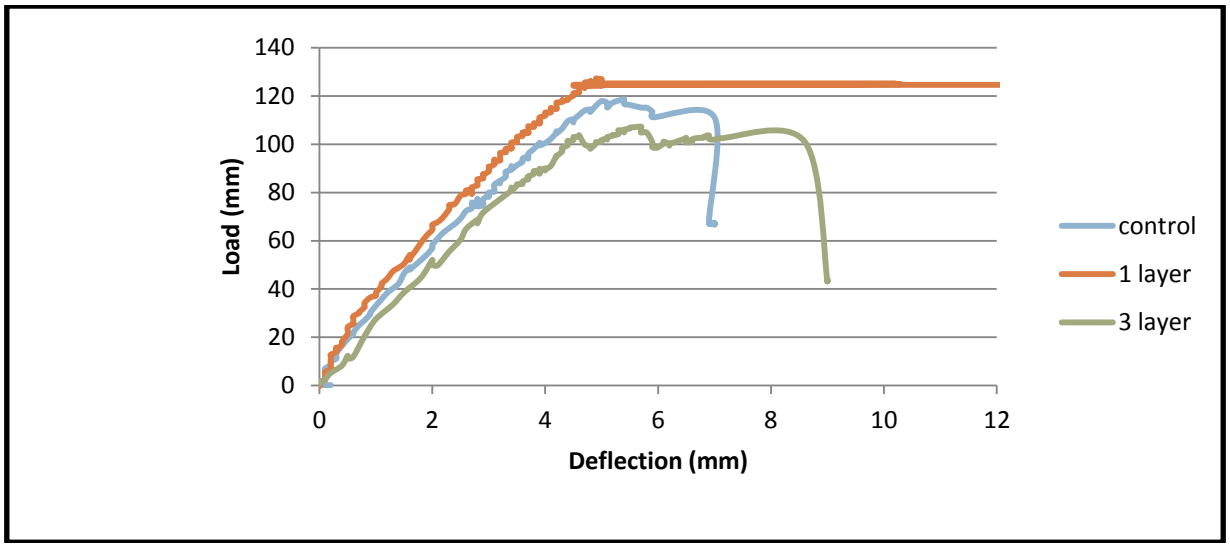


Figure 4 load vs deflection for 1, 3 layer

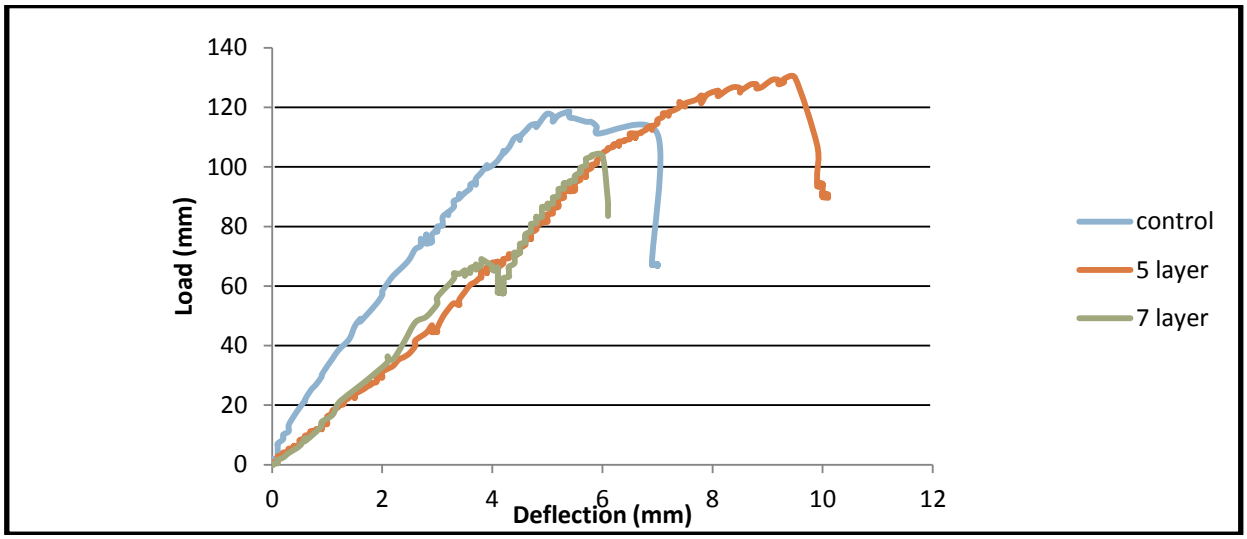


Figure 5 load vs deflection for 5, 7 layer

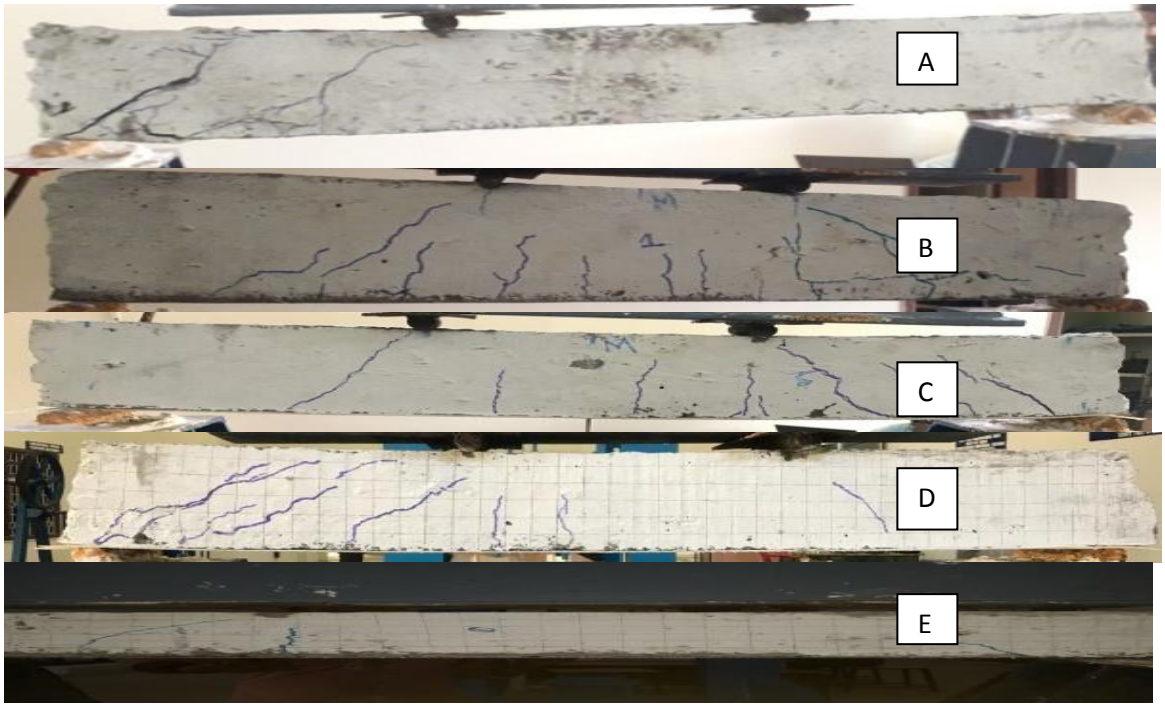


Figure 6 crack pattern
A)Control beam B)1 Layer C) 3 Layer D) 5 Layer E) 7 Layer

CONCLUSION:

Rise the number of FRP coat enhanced the flexural strengthening capacity and altered the failure mode. Whereas, the correlate with outcome of the number of FRP layer(5 and 7) was trival due to the Debonding of FRP from the concrete layer , Fibre rupture .This failure is common and brittle .The beam strengthened with 1 and 3 layer of GFRP had a significant increase in load with minimum deflection.

REFERENCES

1. **Ahmed Khalifa** (2016)**,** Flexural performance of RC beams strengthened with near surface mounted CFRP strips**.** *Alexandria Engineering Journal, 55, 1497–1505*

2. **Gonzalez-Libreros, Sneed , Antino , Pellegrinoain** (2016) Behavior of RC beams strengthened in shear with FRP and FRCM Composites. *Engineering Structures,150,(830–842).*

3. **Saad RKoutas ,Dionysio Bournas** (2017) TRP versus FRM in flexural strengthening of RC beam. *construction and building material* ,151,(279-291)

4. **Saad RKoutas ,Dionysios A Bournas** (2017) TRP versus FRM in flexural strengthening of RC beam at high temperature. *construction and building material,* 154, (424-437)