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TO STUDY ON FLEXURAL STRENGTHNING OF CORROSION DAMAGED RC BEAM BY FRP WRAPPING

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Abstract - *In this paper study the flexural strengthening of corrosion damaged reinforced concrete beam by FRP wrapping. There are 9 beams were casted and tested and the dimension of the beam of (700X150X100) mm is considered in this study. M40 grade concrete and Fe500 grade steel has been used for casting beams. For the study purpose in 9 beams three control beams of normal steel, three control beams of corrosion steel and three beams of corrosion steel is retrofitted with FRP sheet wrapping around all the sides of beam. The ultimate load carrying capacity and deflections of the beams were compared. Thus, repairing with FRP sheets increases the load carrying capacity and flexural strength of the beam and reduces the stress range over the steel reinforced bars.*

Key Words: Fibre reinforced polymer(FRP), Resin.

1. INTRODUCTION

Reinforced concrete structures are important elements of infrastructure and building. Now a days buildings are found to be distressed or damaged. Such a building requires immediate attention and need of flexural strengthening, retrofitting bring them back to functional use again. Today deterioration of RC structures are one of the major problems in civil industry has large number of buildings are constructed according to older design methods. Since replacement of such deteriorated structure takes plenty of money and time, flexural strengthening has become an acceptable way of improving the performance of the structure and extending their service. Many modern technique are involved in proper effective flexural strengthening and retrofitting methods. In this project we are studying on flexural strengthening of corrosion damaged RC beam by FRP wrapping.

1.1 Aim and Objectives:

The aim of this paper is "To study flexural strengthening of corrosion damaged RC beam by FRP wrapping"

The objectives of this study are:

- Effect on flexural strength of the corrosion damaged RC beam retrofitted with FRP wrapping by comparing the load carrying capacity of the retrofitted beam and control beam.
- To determine flexural rigidity of corrosion damaged RC beam retrofitted with FRP wrapping by measuring deflection of the retrofitted beam and comparing with the controlled beam.

2. Material

The materials are used for casting of beam consists of cement, fine aggregate, coarse aggregate and water. M40 grade concrete has been used for casting beams. OPC 53 grade cement used. The physical properties of cement is obtained from various tests according to Indian standard specification. M sand used as fine aggregate in the concrete mix and cement mortar. Specific gravity of fine aggregate is 2.62 and sieve analysis results shows zone 2 as per Indian standard. Crushed stone aggregate contain 60% of 20mm aggregate and 40% of 12.5mm aggregate used throughout the experiment.

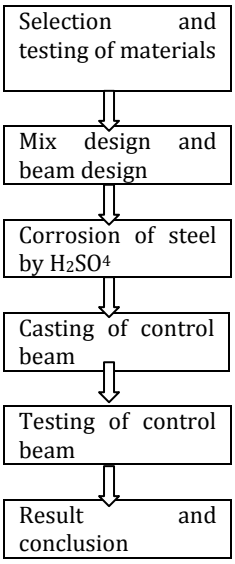
FRP: Fibre Reinforced polymer is a composite material made of polymer matrix reinforced with fibers.

FRP have high durability, good fatigue resistance, ease of installation and repair, corrosion resistance, high ultimate strength and lower density than steel, unlimited availability of size, geometry and dimensions.

RESIN: Resin is a solid or semi solid, amorphous products derived from living natural sources which is insoluble in water.

Resin have good adhesive performance, insoluble in water and resins are heavier than water.

2.1 Methodology



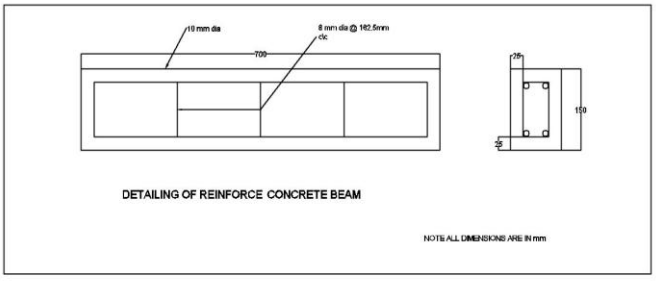
3. MIX DESIGN:

In this experiment M40 grade of mix design was designed as per IS 10262-2009.

Materials	Water	Cement	Fine aggregate	Coarse aggregate
Ratios	0.5	1	1.78	2.9
Total quantity for 9 beams	18.61ml	38kg	63.54kg	107kg

3.1 BEAM DESIGN:

TMT steel of grade Fe-500 of 10mm diameter was used as main reinforcement, 8mm bars used as stirrups and 162.5mm spacing provided throughout the length.



4. CASTING OF BEAMS:

The mould is made by iron. The dimensions of all mould specimens are same. The length of beam is 700mm and cross sectional dimensions of beam is 150mm*100mm. the inner surface of the mould is cleaned by oil or grease. The concrete materials are mixed by hand itself. Initially reinforcement was placed at 25mm spacing and beam is filled with mortar. The mould has to be demoulded after 24 hours and then keep it in a curing tank for 28 days.

Retrofitting of beams:

The full wrapping technique is used for method of retrofitting. At the time specimen surface is made rough by wire mesh and then cleaned. The epoxy resin is applied over the beams and FRP sheets are placed on the beams. This procedure done in room temperature. Before testing, beams are cured for 3 days at room temperature.

5. TESTING OF BEAMS:

The test procedure is same for all beams. These beams were placed on the loading frame leaving 50mm from both ends of the beam and apply the load uniformly by using of mild steel rollers placed on the beam. Usually loads are distributed at two points through the I section. Loading was done by hydraulic jack .dial gauge is used for measuring deflection. The deflection of beam was observed till the specimen failure occurs. If the specimen fails the needle return back in UTM machine. After testing of all beams load v/s deflection graph is plotted.

6. RESULT AND DISCUSSION:

1. Control beam with normal steel:

Load in KN	Deflection in mm	Load in KN	Deflection in mm
0	0	30	1.86
5	0.75	35	2.05
10	0.97	40	2.25
15	1.22	45	2.47
20	1.45	50	2.7
25	1.65	55	3

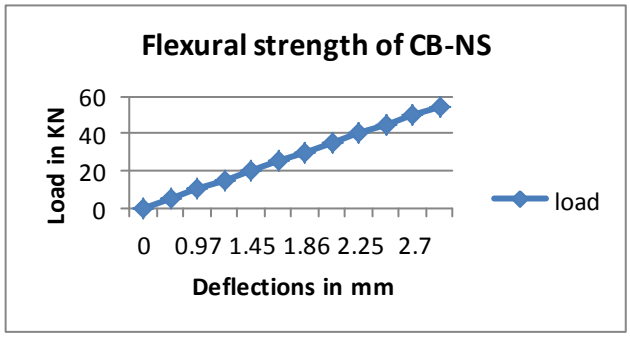


Fig no : 3 load v/s deflection graph of CB-NS

2. control beam with corrosion steel:

Load in KN	Deflection in mm	Load in KN	Deflection in KN
0	0	25	1.65
5	0.5	30	1.96
10	0.72	35	2.5
15	0.92	40	2.85
20	1.2	45	3.15

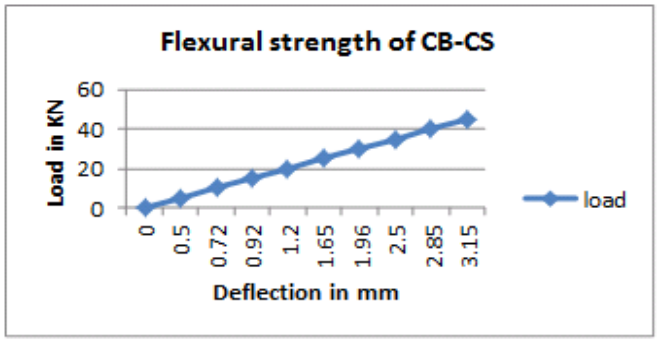


Fig No : 4 Load v/s Deflection of CB-CS

3. Control beam of corrosion steel with FRP:

Load in KN	Deflection in mm	Load in KN	Deflection in mm
0	0	30	1.8
5	0.7	35	2.0
10	0.94	40	2.2
15	1.09	45	2.38
20	1.2	50	2.7
25	1.3	55	3.12

Fig No 5 : Load v/s deflection graph of CB-NS

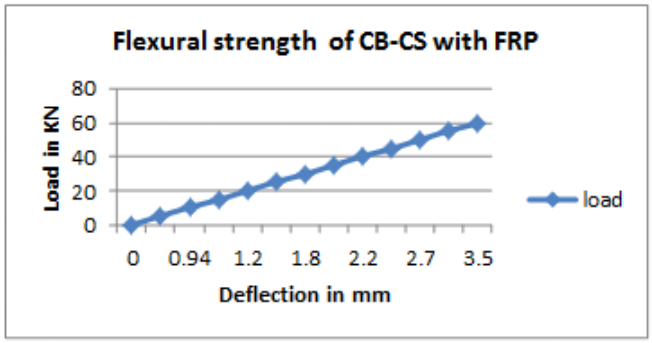


Fig No 5 : Load v/s deflection graph of CB-CS with FRP

4 . Failure load of all beams:

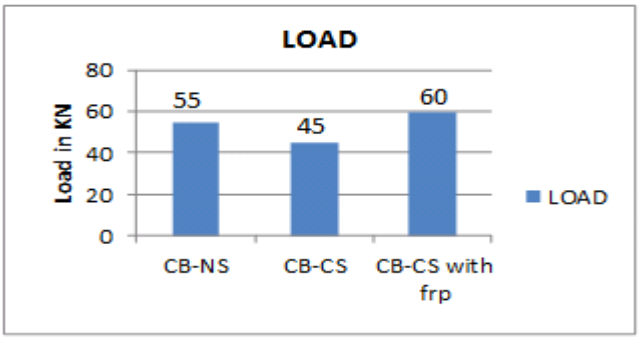


Fig No : 6 failure load of all beams

CONCLUSION:

- In this paper to study the flexural strengthening corrosion damaged RC beam retrofitted with FRP wrapping.
- In this project consider 9 beams for study purpose 3 beams of CB-NS, 3 beams of CB-CS and 3 beams retrofitted with FRP.
- Load carrying capacity of the CB-CS with FRP is increased 25% when compared to CB-CS.
- CB-CS with FRP takes higher load when compared to CB-NS, CB-CS.
- CB-CS with FRP carrying high ultimate load capacity and reduce the deflection and reduce the stress range on reinforced steel bars.
- The beam retrofitted with one layer of FRP are the more efficient for strengthening and reduce the cost ratio.

SCOPE OF FUTURE WORK:

- In the present study, rectangular beam specimens have been considered. The work can be extended for flanged beam specimen and other shape of beam specimen.
- In the present study, 1 layer of FRP have been used. The work can be extended for higher number of layer of FRP for determining the load carrying capacity and maximum deflection.

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