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"Strengthening Of PCC Beams by Using Different Types of Wire Mesh Jacketing"

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Abstract: *This paper presents the effect of the use of different types of wire mesh jacketing to the PCC beams. The experimental work is mainly concerned with the study of flexural strength of concrete by different types of wire mesh jacketing. This study brings out the importance of use of strengthening of existing structure technology by using locally available wire mesh. In this paper, the beams of plain cement concrete are bonded with locally available wire mesh to strengthen of structural member for increase its strength. The method mention in this paper is most suited for strengthening and retrofitting due to their easy availability, economy and their property of being cast to any shape without needing significant formwork.*

Kevwords: *Flexural strenath. Wire mesh iacketina. Strenathenina. Retrofittina.*

I. Introduction

It is well-known that reinforced concrete beams which have been subjected to a fire will lose a major part of their strength and stiffness parameter. These two factors (strength and stiffness) are a major concern relating to the safety of concrete structures after fire. Generally, post-heated concrete structures are capable of being repaired economically rather than completely demolished and re-built. The most common technique for repairing fire damaged reinforced concrete beams is using a wire mesh jacket.

In recent years the easy handling and speedy repairing technique, with numerous advantages, are making the wrapping system of locally available wire mesh jackets the preferred technique for the repair and strengthening of a large number of projects. It has been found previously that wire mesh jacket can provide an effective confinement of reinforced concrete beams and therefore, it has a great potential to be used as a strengthening material.

A wire mesh jacket consists of a thin wire, wrapped around various beam shapes, in which finely divided wire meshes are distributed spatially. The distribution of such small diameter wires closely and uniformly spaced improves the overall properties of the beam member, such as impact resistance, fatigue resistance, tensile strength, toughness, flexural strength. Although labourintensive, the workmanship required for the fabrication of wire mesh is fairly low level and its constituents are typically locally available.

II. Objectives

The objectives of the project are in the form of the following things:

1. Technical aspects related to results:
   - To increase the flexural strength of concrete beam by using wire mesh.
   - Comparison of beams containing different types of wire mesh and different types of its orientations with PPC M30.

III. Experimental Investigation

3.1 Test materials and mix proportions

Portland pozzolan cement with ISI mark was used for tests on fresh and hardened concrete. The compressive strength was 28.04 MPa and 46.35MPa at 7 and 28 days respectively. Local river sand and coarse aggregate with fineness modulus of 3.61 and 4.58 respectively were used. The coarse aggregates with basaltic origin, maximum size 20 mm were from local stone crusher. Potable water, with pH of 7.1, was used. The designed mix M30 with proportion 1:1.48:2.69 (Cement: Fine aggregate: Coarse aggregate) for concrete. The mix design was done as per IS 10262:2009. Water cement ratio of 0.45 kept constant for both the types of concrete and for all specimens. Rectangular opening and hexagonal opening wire meshes are used for this research. The diameter of wire is 0.9mm for hexagonal mesh with 43.7 mm^2 opening area and diameter of wire is 0.6mm for rectangular mesh with 24 mm^2 opening area.The both types of wire mesh are withthin wires and woventype. Wire mesh adhered with concrete surface by using Epoxy.

3.2 Specimen Details

There were two series. PCC beams with one side wire mesh other is three side wire mesh PCC beams. For each series six beams (150mm x 150mm x 700mm) in that three are of hexagonal openings and other is rectangular openings, were cast as control specimens. Specimens were cured for 28 days.Two types of wire mesh as denoted by 1RWMC, 3RWMC, 1HWMC, 3WHMC. 1- denotes one side wire mesh similarly, 3- denotes three side wire mesh , R-denotes rectangular openings ,H- denotes hexagonal mesh openings , W- denotes wire , M- denotes mesh , C- denotes concrete.

3.3 Testing

Testing was carried out on 6 beams of both series for flexure. For flexural strength beams were simplysupported on constant effective span of 900 mm under two point concentrated symmetrical loads for both series. All the beams were having constant overall span and width of 1000 mm and 150 mm respectively**.**

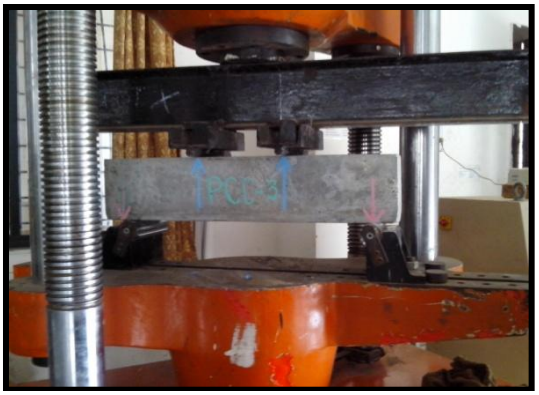


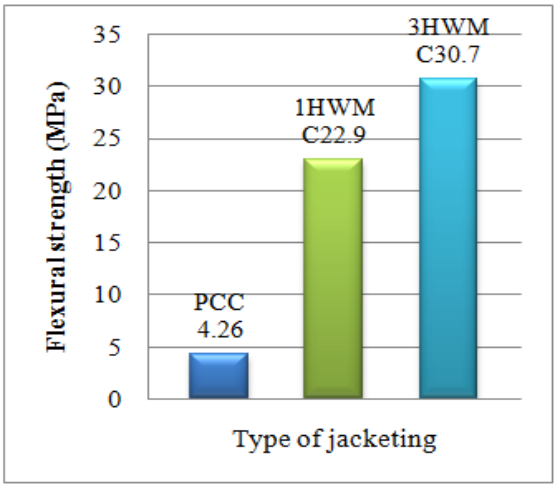
Figure 1: Flexural test setup

The beams were kept on universal testing machine. The beams were tested under gradually applied two points loading on Universal Testing machine (UTM) as shown in Fig. 1 for flexural strength. Ultimate load and modes of failure of beam were noted.

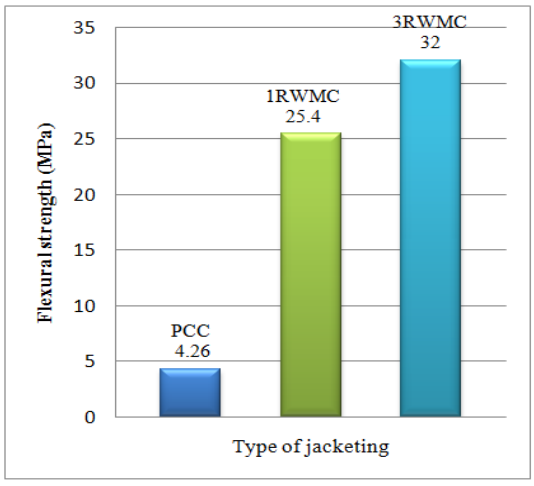
IV. Discussion and result

4.1 Flexural Strength

It is observed that all the beams are failed in flexure and the flexural strength of concrete increases by jacketing with locally available wire mesh. Plain cement concrete has very low tensile strength whereas locally available wire mesh has a good tensile strength as compared to concrete. After adhering locally available wire mesh to a concrete surface, makes the concrete able to transmit bending stresses from concrete to wire mesh which further increase a flexural strength and improve overall behavior of concrete.



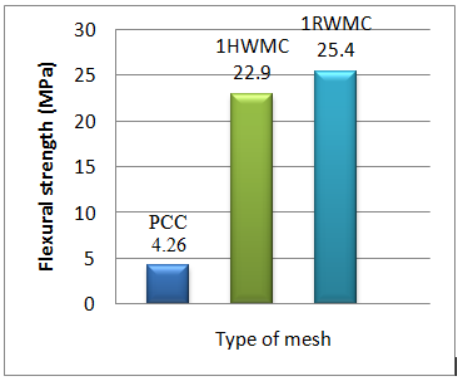
Graph no.1: Flexural strength of hexagonal wire mesh jacketing



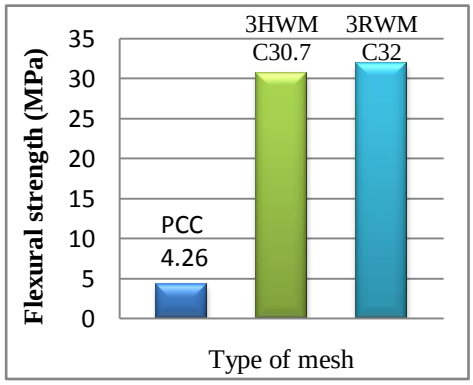
Graph no.2: Flexural strength of rectangular wire mesh jacketing

We have used the different types of wire mesh to check performances of concrete under the flexural strength. It is observed that wire mesh jacketing to three sides of concrete surface gives more flexural strength compared to single side (bottom side) jacketing. Because, the test results and the crack patterns of tested specimens show that all three sides jacketing techniques are effective to overcome the bending stresses problem of one side jacketing. Among all jacketing techniques considered in this study 3RWMC type jacketing shows the best performance in carrying concentric loading than the 3HWMC.

There is no bond failure at the end of the grid systems was observed in these beams up to the ultimate load, debonding area is more in hexagonal opening wire mesh as compared to rectangular opening wire mesh.



Graph no.3: Flexural strength of one side wire mesh jacketing



Graph no.4: Flexural strength of three side wire mesh jacketing

V. Conclusions

1. This method has been utilized as an alternative repair/ strengthening technique for increasing flexural strength of plain cement concrete.
2. All the jacketed beams are failed in ductile manner, as the bending stresses transmit from concrete to wire mesh which further increase a flexural strength and improve overall behavior of concrete.
3. A test result shows that, Flexural strength of 1HWMC beam and 1RWMC beam is increased by 4.37 times and 4.96 times than that of Plain cement concrete respectively.
4. A test result shows that, Flexural strength of 3HWMC beam and 3RWMC beam is increased by 7.2 times and 7.5 times than that of Plain cement concrete respectively.
5. A test result shows that, Flexural strength of 1RWMC beams is increased by 10.92% than that of 1HWMC beams and flexural strength of 3RWMC beams is increased by 4.23% than that of 3HWMC beams.
6. A test result shows that, Flexural strength of 1HWMC beams is increased by 34.06% than that of 3HWMC beams and flexural strength of 1RWMC beams is increased by 25.98% than that of 3RWMC beams.

REFERENCES

[1.] GopalCharanBehera, RaoT.D.Gunneswar and Rao C.B.K, "Torsional strength of ferrocement "U" wrapped normal strength beams with only Transverse Reinforcement". The 2nd International Conference on Rehabilitation and Maintenance in Civil Engineering, published by Proceedia Engineering vol. 54 (2013), pp 752 – 763.

[2.] YasmeenTalebObaidat, Susanne Heyden, Ola Dahlblom, Ghazi Abu-Farsakh, Yahia Abdel-Jawad, "Retrofitting of reinforced concrete beams using composite laminates". Construction and Building Materials Published by science direct vol. 25 (2011), pp 591–597.

[3.] Hani H. Nassif, HusamNajm, "Experimental and analytical investigation of ferrocement–concrete composite beams". Cement & Concrete Composites, Published by science direct vol. 26 (2004), pp 787–796.

[4.] ShrutiRatnaparkhe, AshishNim and SonamChandore, "A study on ferrocement-concrete composites".Published by VSRD International Journal of Civil Engineering, Vol. 3 No. 2 February 2013.

[5.] Ghobarah, H. AbouElfath, "Rehabilitation of a reinforced concrete frame using eccentric steel Bracing". Published byEngineering Structures science direct vol. 23 (2001), pp 745–755.

[6.] 6.Ibrahim Erdema, UgurhanAkyuzb, UgurErsoyb, GuneyOzcebe, "An experimental study on two different strengthening techniques for RC frames". Published by Engineering Structures science direct vol.28 (2006), pp 1843–1851.

[7.] M.R. Islam, M.A. Mansur, M. Maalej, "Shear strengthening of RC deep beams using externally bonded FRP systems". Cement &Concrete Composites Published byscience direct vol. 27 (2005), pp 413–420.