International Journal of ChemTech Research
CODEN (USA): IJCRGG, ISSN: 0974-4290, ISSN(Online):2455-9555
Vol.10 No.8, pp 226-231, 2017

Behavioural Approach of Concrete Prisms with Replacement of Reinforcement by Wiremesh

R.Anuradha*, Kishore Krishnan

Department of Civil Engineering, SNS College of Technology, Coimbatore, Tamilnadu, India.

Abstract : This paper presents the results of an investigation aimed at behavioural approach of concrete prisms with replacement of reinforcement by wiremesh in various grade of concrete. To accomplish this objective, an experimental program was conducted. The experimental program comprised, casting and testing of forty-eight prisms of total dimensions 500 X 100 X 100 mm consisting of no layer, one layer, two layer and three layer of 1.3mm thick welded wiremesh with spacing between welded wire mesh is 22mm and concrete grades with M20, M25, M30, M35. The results indicate that the use of wiremesh layers slightly increases the ultimate flexural load. The first crack load increased with the increase in the percentage of mesh reinforcement and the mesh layer thickness.
Key Words : Wire mesh, Flexural strength and crack width.

1.0 Introduction

Wire mesh is a construction material that proved to have superior qualities of crack control, impact resistance, and toughness, largely due to the close spacing and uniform dispersion of reinforcement within the material[5]. One of the main advantages of wire mesh is that it can be constructed with a wide spectrum of qualities, properties, and cost, according to customer's demand and budget. The ACI committee 549 published a general definition of wire mesh states that ''Wire mesh is a type of thin wall reinforced concrete commonly constructed of hydraulic cement mortar reinforced with closely spaced layers of continuous and relatively small size wire mesh, the mesh may be made of metallic or other suitable materials'' (ACI 2006).Recently, wire mesh has received attention as a potential building material, especially for roofing of housing construction (National Academy of Sciences 1973)[7] and has been used for several applications (Naaman 2000)[18,19]. Wire mesh has received attention as a potential building material. Many investigators have reported the physical and mechanical properties of this material, and numerous test data are available to define its performance (Naaman 1979; Yogendran et al. 1987; Korany 1996)[18].

The wire mesh has been used as sole construction material and as a repair material. Al-Rifaei and Hassan (1994)[1] presented the results of an experimental and theoretical study of the behavior of channel shaped wire mesh one-way bending elements. The results showed that this type ofelements can undergo large deflections before failure and is suitable for construction of horizontally spanning unit for one-way bending. Fahmy et al. (2006, 2012)[8,9] have used wire mesh laminate for constructing sandwich and hollow core precast panels for wall construction. Chandrasekhar Rao et al. (2008)[3] reported the results of an experimental study on the strength and behavioural aspects of voided wire mesh channels for precast beams. Their test results dictated drop in flexural strength of the voided channels as compared with the solid ones. However, this drop is very negligible compared to the decrease in the weight of the member. Mays and Barnes (1995)[17] presented the results of an experimental investigation to examine the feasibility of using wire mesh as a low permeability

cover layer to reinforced concrete members located in environments, where there is a high risk of reinforcement corrosion. They found that the resistance to chloride penetration in accelerated ageing tests was enhanced by using styrene butadiene rubber or acrylic bond coat between the wire mesh forms and the concrete. They also reported that this protective cover could be precast and work as permanent formwork for the concrete element. They found the use of such permanent wire mesh formwork gave an increase in strength of 15 % over the conventional reinforced concrete. Singh et al. (1994) and Gregson and Dickson (1994)[11] reported on the use of innovative combination of wiremesh and reinforced concrete to construct the distinctive exposed structure of the first floor slab of the Schlumberger Cambridge Research building. Fahmy et al. (1997a, 1997b, 1999)[8,9]reported in the literature the results of investigations aimed at using wire mesh forrepairing reinforced concrete beams, slabs, and columns[2]. Their reported experimental results showed the effectiveness of using the wire mesh laminates for repairing these structural elements.This paper presents that the use of wire mesh layers slightly increases the ultimate flexural load and the first crack load increased with the increase in the percentage of mesh reinforcement and the mesh layer thickness.

2.0 Experimental Programme

The experimental program of the present investigation program comprised casting and testing of forty-eight beams of total dimensions 500 X 100 X 100 mm consisting of no layer, , one layer, two layer and three layer of welded wire mesh with 1.3mm thick and spacing between welded wire mesh is 22mm. The position of reinforced wire mesh is in compression zone, spacing between the wire mesh is around 10mm each and with cover thickness of 10mm. The grades of concrete were used for casting prism specimen are M20, M25, M30, M35. The following code was used for the sample designation: the first letter defines the type of mesh (W for welded wire mesh and E for expanded steel mesh), the second letter defines the number of reinforcing mesh layers (S for single layer D for double layers and T for triple layers).

The forty-eight test prisms were divided into four groups based on their concrete's grade and each group contained four sub groups based on their reinforcement quantity. After casting and curing of test specimens the tests are carried out.

3.0 Material

For casting of concrete generally used raw materials are Cement, Fine aggregate (River sand), Coarse aggregate and Water were used. Additionally Bio-medical waste was used to investigate the effect on properties of concrete.

3.1Cement

Ordinary Portland cement were used satisfying all the IS requirements was used in making the concrete. The physical properties of cement were specific gravity 3.15, Specific area (m^2/kg) 319.

3. 2Fine Aggregate

Sand i.e., fine aggregate obtained locally from nearest river passing through 4.75 IS sieve having fineness modulus -2.60& confirming to zone-III as per IS: 383-1970.Its specific gravity was 2.58 respectively.

3.3Coarse aggregate

Blue metal i.e., Coarse aggregate obtained locally. 20 mm Nominal size Graded aggregate having fineness modulus – 3.92 & confirming to IS:383-1970 specification. The physical properties of CA were specific gravity 2.78, Water absorption – 0.9%.

3.4Wire mesh

1.3mm thick welded wire mesh with spacing between welded wire mesh is 22 mm..

4.0 Mix Design

Mix design As per Indian standard is a process of selecting suitable ingredients and determining their relative proportions with the objective of producing **concrete** of having certain minimum workability, strength and durability as economically as possible.

4.1 Mix proportion

Table 1: Mix ratio

Grade	Mix
M 20	1 : 2.21 : 2.29 : 0.55
M 25	1 : 2.01 : 2.02 : 0.5
M 30	1 : 1.737 : 1.81 : 0.45
M 35	1: 1.46 : 1.58 : 0.4

5.0 Casting

In the casting process, all the ingredients were first mixed in dry condition, to the dry mix; calculated quantity of water was added and thoroughly mixed to get a uniform mix. Shuttering oil was applied on the inner face of plywood mould and the reinforcement cage was compacted by tamping rod as shownin Figure 3. The specimens were cured in curing tank for 28 days.

In the casting process, all the ingredients were first mixed in dry condition, to the dry mix; calculated quantity of water was added and thoroughly mixed to get a uniform mix. Shuttering oil was applied on the inner face of plywood mould and the reinforcement cage was compacted by tamping rod as shownin Figure 3.

Figure 1: Casting of prism specimen

6.0 Results and Discussion

The result of experimental investigation carried out to determine Flexural strength, first crack load and are discussed here in after.

6.1 Flexural strength & First crack load

From this experiment, it is evident that the flexural strength and first crack load of reinforced concrete made by using wire mesh are increased with replacement level as shown in Table 2, Figure 2, Figure 3, Figure 4, Figure 5 & Table 3, Figure 6, Figure 7, Figure 8, Figure 9.

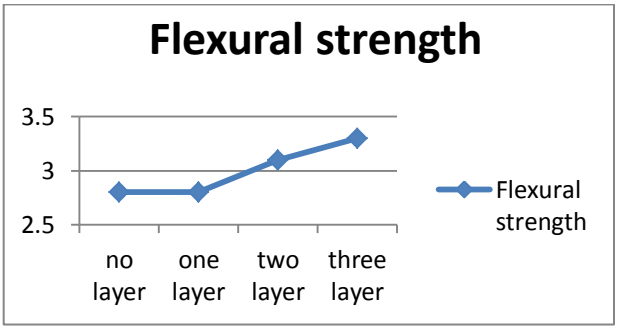

Figure 2: Flexural strength of M 20

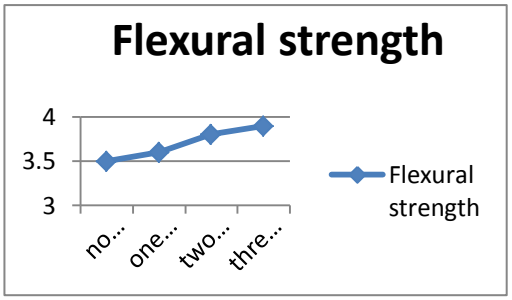

Figure 3: Flexural strength of M 25

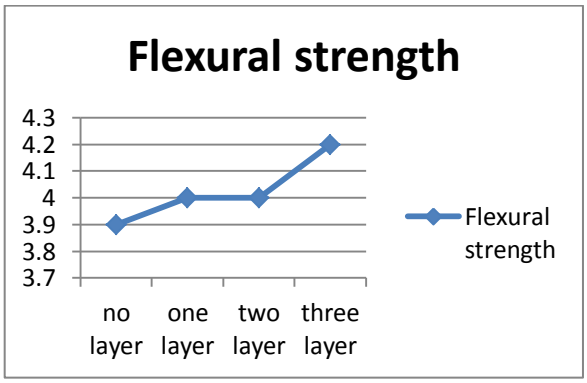

Figure 4: Flexural strength of M 30

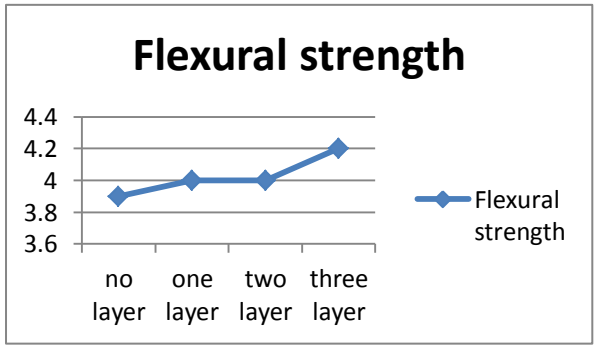

Figure 5: Flexural strength of M 35

Table 2: Flexural strength of prisms

Mix	NO. OF LAYERS OF WIRE MESH	FLEXURE STRENGTH N/mm^2
M 20	0	2.8
	1	2.8
	2	3.1
	3	3.3
M 25	0	3.5
	1	3.6
	2	3.8
	3	3.9
M 30	0	3.9
	1	4
	2	4
	3	4.2
M 35	0	4
	1	4.2
	2	4.4
	3	4.5

Table 3: First crack load of prisms

Mix	NO. OF LAYERS OF WIRE MESH	FIRST CRACK LOAD N/mm^2
M 20	0	2.8
	1	2.8
	2	3
	3	3.1
M 25	0	3.5
	1	3.6
	2	3.5
	3	3.6
M 30	0	3.9
	1	3.9
	2	4
	3	4
M 35	0	4
	1	4
	2	4.1
	3	4.2

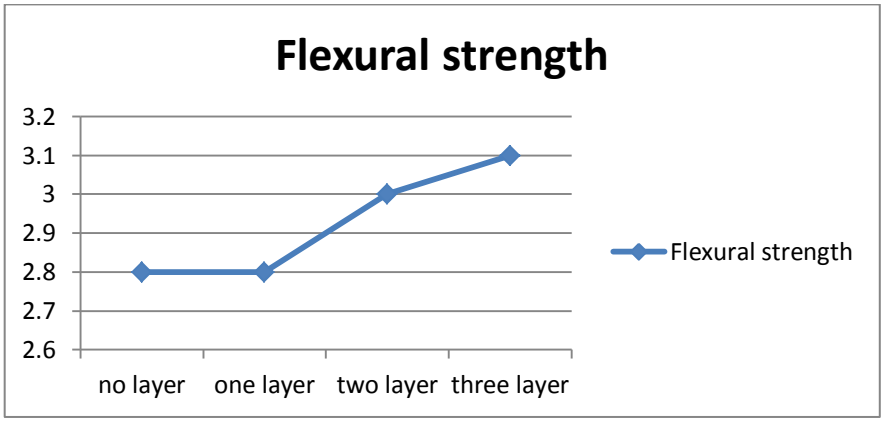

Figure 6: Flexural strength of M 20

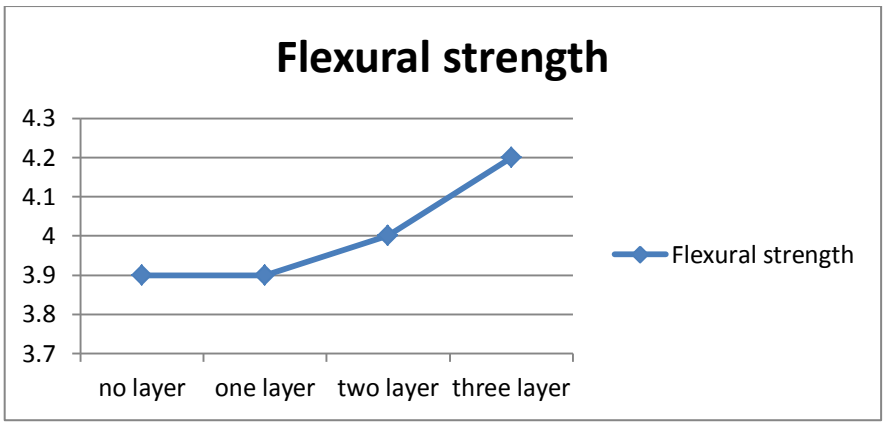

Figure 8: Flexural strength of M 35

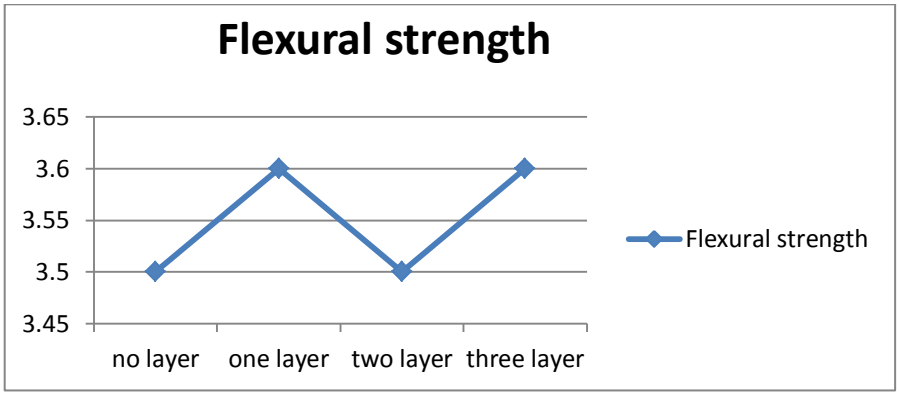

Figure 7: Flexural strength of M 25

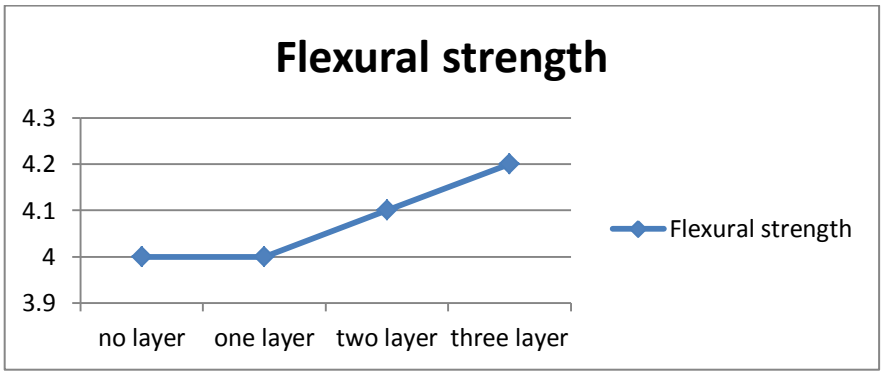

Figure 9: Flexural strength of M 35

7.0 Conclusion

This paper proves that concrete prisms with replacement of reinforcement by wire mesh is superior in Flexural strength and First crack load.

8.0 References

1. Abdel TawabAlaa. (2006). Development of permanent formwork for beams using wire mesh laminates, P.H.D. Thesis submitted to Menoufia University, Egypt.
2. Al-Rifaei, W. N., & Hassan, A. H. (1994). Structural behaviour of thin wire mesh one-way bending elements. Journal of
3. wire mesh, 24(2), 115–126.
4. American Concrete Institute, ACI Committee 549-1R-88. (2006). Guide for the design, construction, and repair ofwire mesh. manual of concrete practice (p. 30). Framington Hill: American Concrete Institute, ACI Committee 549-1R-88.
5. ASTM Committee C09 on Concrete and Concrete aggregate (2012). Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete, ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959, US, 12p.
6. Chandrasekhar Rao, T., GunneswaraRao, T. D., &RamanaRao, N. V. (2008). An experimental study on wire mesh channel units under flexural loading. International Journal of Mechanics and Solids, 3(2), 195–203.
7. Desayi, P., & Nandakumar, N. (1995). A semi-empirical approach to predict shear strength of wire mesh. Cement and Concrete Composites, 17(3), 207–218.
8. Fahmy, E. H., Shaheen, Y. B. I., AbouZeid, M. N., &Gaafar, H. M. (2006). wire mesh sandwich and hollow core panels for wall construction. Journal of wire mesh, 36(3), 876–891.
9. Fahmy, E. H., Shaheen, Y. B. I., AbouZeid, M. N., &Gaafar, H. M. (2012). wire mesh sandwich and hollow core panels for floor construction. Canadian Journal of Civil Engineering, 39(12), 1297–1310.
10. Fahmy, E. H., Shaheen, Y. B. I., &Korany, Y. S. (1997a). Repairing reinforced concrete beams by wire mesh. Journal of wire mesh, 27((1), 19–32.
11. Gregson S., & Dickson M. (1994). Schlumberger Cambridge Phase 2: Design and Construction of First Floor Slab Using wire mesh Soffit Units, wire mesh. In P. J. Nedwell, & R. N. Swamy (Eds.), Proceedings of the Fifth International Symposium, (pp. 227–239) New York, NY: Taylor and Francis.
12. International wire mesh Society (IFS), IFS Committee 10. (2001). wire mesh Model Code, Asian Institute of Technology, International wire mesh Information Centre, Thailand.
13. Karlsson, M. (1997). Recycling of concrete (p. 58). Goteborg, Sweden: Chalmers University of Technology.
14. Korany Y. S. (1996). Repairing reinforced concrete columns using wire mesh laminates, MS Thesis submitted to TheAmerican University in Cairo, Egypt, 151p.
15. Mansur, M. A., & Ong, K. C. G. (1991). Behaviour of reinforced fibre concrete deep beams in shear''. ACI Structural
16. Journal, 88, 98–105.
17. Mays, G. C., & Barnes, R. A. (1995). wire mesh permanent formwork as protection to reinforced concrete. Journal of wire mesh, 25(4), 331–345.
18. Naaman, A. E. (1979). Performance criteria for wire mesh. Journal of wire mesh, 9(2), 75–91.
19. Naaman, A. E. (2000). wire mesh and Laminated Cementitious Composites. MI: Techno Press.
20. National Academy of Sciences. (1973). wire mesh: applications in developing countries. A report of an adhoc panel of the advisory committee on technological innovation board on science and technology for international development office of the foreign secretary, Washington, DC.
21. Paramasivam, P., & Nathan, G. K. (1984). Prefabricated wire mesh water tanks. Journal of the American Concrete Institute, 81(6), 580-586.

*****