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Analytical Analysis of Flexural Behaviour of Ferrocement Panels

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ABSTRACT: This analytical work presents the details of the flexural behavior of ferrocement using the guidelines of ACI549.1R-93 (Guide for the Design, Construction, and Repair of Ferrocement). In this report, we have carried out an analytical analysis of ferrocement panels by three methods (1) Moment Area Method, (2) Plastic Moment Method (3) Prediction Equation Method. The variable parameters were the number of mesh layers, the thickness of ferrocement panels, and mortar strength.The main objective of this work is to study the effect of using different no of wire mesh layers on the flexural strength of flat Ferro-cement panels and to compare the effect of varying the no of wire mesh layers and the use of steel fibers on the ultimate strength and ductility of Ferro-cement slab panels. The number of layers used is two, three, and four. Slab panels of size (600*200) with thicknessesof 20, 30 & 40 mm are reinforced with welded square mesh with varying mesh layers. From the analysis, it can be observed that, with an increase in thickness of ferrocement panels and the number of mesh reinforcements, the bending strength, flexural strength & load carrying capacity increase. The flexural strength and ultimate loads depend on the number of reinforcing mesh layers used in the ferrocement panel.

Keywords: Mortar Strength, Reinforced Mesh Layer, Efficiency Factor, Modulus of Elasticity, Service Moment, Neutral Axis, Flexural Strength

I. INTRODUCTION

Civil infrastructures worldwide are on the verge of severe deterioration due to harmful attacks such as carbonation, chloride attack, etc. Moreover, many civil structures are no longer considered safe due to increased load specifications as per the design codes due to overloading, under-design of existing structures, and lack of quality control. Therefore, older structures must be repaired or strengthened to meet the exact requirements to maintain efficient serviceability.

Ferrocement is a form of reinforced concrete using closely spaced multiple layers of mesh or small diameter rods thoroughly infiltrated with, or encapsulated in, mortar. It is a very durable, cheap, and versatile material. The mesh can be made of metallic or other suitable material. Since these materials are widely available and relatively low in cost, the building techniques are enough to be done by unskilled labor. It can be shaped into any form, formed into a section less than an inch thick, and assembled over a light formwork. The advantage of Ferro-cement is that it requires no formwork, which allows it to be fabricated into general shapes, reinforced concrete or steel. Therefore, Ferro-cement is an attractive alternative to reinforced concrete and steel structures. The material may be used in several designs such as boats, buildings, water tanks, etc.

Ferrocement definition according to different organizations:

I) According to United Nations High Commissioner for Refugees (UNHCR), ferrocement is defined as ‘A thin-walled construction, consisting of rich cement mortar with uniformly distributed and closely spaced layers of continuous and relatively small diameter mesh (metallic or other suitable material).’ (Reference: UNHCR-Large ferrocement Water tank Manual July 2006).

II) ACI committee-549 describes it: ‘Ferrocement is a form of reinforced concrete using closely spaced multiple layers of mesh and small diameter rods completely infiltrated with, or encapsulated, in mortar. The most common reinforcement is steel mesh’ (reference – ACI 549.1R-93- Guide for the design, construction, and repair of ferrocement).

II. LITERATURE REVIEW

Bhargav Y Desai[1], Jaldipkumar J Patel[2] carried out an experimental analysis on ferrocement panels to study their flexural behavior fortified with various number of wire mesh layers. The main objective of this experimental work is to analyze the effect of using varying number of wire work layers on the flexural strength of ferrocement panels, and the impact of steel filaments and volume part on the flexural strength of ferrocement panels. The materials used for this work are: Ordinary Portland Cement (Grade 43), Sand-Passing through a 2.36 mm I. S. sieve, Water-Normal Drinking Water, Mesh Used- Welded Square Steel Mesh having a diameter of 1.02mm. Steel strands of a ridged sort with angle proportion. The cement sand ratio and water content used in the mix were 1: 1.75 & 0.38 respectively. Section boards of size (900mm*200mm) with thicknesses of 25mm, 50mm, and 75mm are incorporated with one, two, and three numbers of wire mesh layers. The boards were subjected to bending under a two-point stacking framework in a UTM machine after 28 days of curing. The authors conclude that the panels produced using ferrocement have indicated malleable conduct. From the test results, it is clear that the ferrocement panel having 75mm thickness has demonstrated the most extreme load carrying capacity. The 25mm thick ferrocement panels have a higher Modulus of Elasticity (KN/mm2) than the 50mm and 75mm thick ferrocement panels. The flexural loads at the first split and at extreme burden depend on the number of incorporated wire mesh layers. Increasing the number of wire mesh layers from 1 to 3 fundamentally increases the flexibility and the flexural strength of ferrocement panels.

S. Deepa Shri[1] and R. Thenmozhi[2] conducted an experimental investigation on ferrocement panels to study their flexural behavior by incorporating polypropylene fibers. Silica fume is added to the mix to reduce the dosage of chemical admixtures needed to get the required slump. It isobvious that adding fibers will significantly improve the ductility, toughness, and flexural strength and reduce the deflection of cementitious materials. In this study, polypropylene fibers are added to the matrix, and the dosage of fibers is taken as 0.3% by the weight of cementitious materials. The size of the weld mesh used is 590mm*290mm, and the diameter of the wire is 1.2mm. A total of 24 slabs (8 series: 3 in each series), 12 of size 700mm* 300mm*25mm, and the rest of size 700mm* 300mm*30mm were cast in steel moulds. The weld mesh layers were bundled with binding wire and placed in the mould keeping a minimum cover of 3mm. The number of mesh layers used was 2 and 3. The authors conclude that the load carrying capacity of SCC ferrocement slab panel with 0.3% fibers is larger compared to that without fibers also, there is a significant increase in the load carrying capacity, energy absorption, and deformation at ultimate load by incorporating fibers. There is an increase in strength with the increase in slab thickness. Hybrid polypropylene fibers reinforced ferrocement specimens could sustain more considerable deflections at yield and ultimate load compared to the SCC ferrocement specimens without fibers. Many micro-cracks are formed before the failure of the specimens, indicating more energy absorption and ductility; the stiffness of the specimens with 2-layers of reinforced weld mesh is lower than that of the specimens with three layers of reinforced weld mesh.

Piyush Sharma[1] carried out analytical research on the design, strength, and serviceability aspects of ferrocement investigating the possibility of using it in different types of advanced construction. This work presents the comparison between the performance of Ferro-cement and reinforced concrete under static load. The main aim of the research is to study the feasibility of Ferro-cement concrete in the design and construction of structures. The author concludes that Ferro-cement construction is an innovative and advanced technique; its readily available materials and ease of construction make it suitable in developing countries for housing, water, and food storage structures. Ferro-cement is found to be a suitable material for repairing or reshaping the defective RCC structural elements and enhancing their performance. Ferro-cement has a slight advantage over conventional materials like RCC steel, wood, and plastic as it is durable, waterproof, and strong, and also competitive in price generally. The Quality of Ferro-cement structuresis better assured because the components are manufactured on machinery set up. Moreover, the execution time at the work site is reduced, contributing least shutdown. The Maintenance cost of Ferro-cement structures as compared to RCC is almost negligible.

III. OBJECTIVE OF EXPERIMENTAL STUDY

The main objective of this analytical work is to study the behavior of ferrocement panels under flexural loading in which welded square mesh has been used as a reinforcement. The various parameters considered in this study are as follows:

a) Effect of panel thickness on the flexural strength of ferrocement panels.
b) Effect of mesh layers on the flexural behavior of ferrocement panels.
c) Effect of increasing mortar strength on the flexural behavior of ferrocement panels.
d) Effect of specific surface area on the flexural behavior of ferrocement panels.

IV. ANALYTICAL ANALYSIS OF FERROCEMENT IN BENDING

For the analytical analysis of flexure of ferrocement panels, ACI 549.1R-93 (Guide for the Design, Construction, and Repair of Ferrocement) was referred to. The bending strength, stress at each reinforced Mesh Layer, and service load are calculated for 27 panels of varying thickness, no. of mesh layer, and mortar strength.

The strength of mortar selected for the analysis was 30MPa, 40MPa & 50MPa. The thickness of the panels was 20mm, 30mm & 40mm. The no. of reinforced mesh layers was 2, 3 & 4.

The length of the panels was taken as 600mm. The minimum clear cover should not be less than 3mm.For Mortar strength of 30MPa, 40MPa & 50MPa, the modulus of elasticity of panels is 20GPa, 22GPa, and 24GPa, respectively

Methods used for the analytical analysis of ferrocement panels:

a) Moment Area Method
b) Plastic Moment Method
c) Prediction Equation Method.

Specifications of Mesh reinforcement:

a) Diameter of wires: 1.4mm
b) Wire Spacing: 15mm*15mm
c) No. of Longitudinal wires: 13
d) Modulus of Elasticity of mesh reinforcement(E_r): 200GPa

Assumptions:

a) Tensile Strength of matrix(σ_{mu}): 2.45MPa
b) Allowable Stress in compression: 14MPa
c) Allowable Stress in reinforcement under maximum service load(σ_{all}): 210MPa

4.1. ANALYSIS OF PANELS USING TRANSFORMED MOMENT AREA METHOD:

Ferrocement panel of size- l×b×h (03 layers of mesh):

Distance of first layer from top fibre: d_1
Distance of second layer from top fibre: d_2
Distance of third layer from top fibre: d_3

Calculation:

C/s area of one wire $= \frac{\pi \times d^2}{4} = A$

The area associated with one layer of mesh, corresponding to 'N_l' longitudinal wires, is given by: $A_{ri} = A_{r1} = A_{r2} = A_{r3} = N_l \times A$

The volume fraction of reinforcement in longitudinal direction:

$$V_{rl} = \frac{N\pi {d_w}^2}{4hD} \quad [1]$$

$$V_r = 2 \times V_{rl} \quad [2]$$

Here, the efficiency factor of reinforcement is 0.5; that is 50% of total volume of mesh is considered to act in loading (i.e., longitudinal) direction.

a) <u>Determining the Cracking Moment and Corresponding Curvature:</u>

Moment of inertia of un-cracked transformed section:

$$(I_{tr})_{uncracked} = \frac{bh^3}{12} + (n-1)\Sigma A_{ri}\left(\frac{h}{2} - d_i\right)^2 \quad [3]$$

Cracking moment,

$$M_{cr} = \frac{2 \times \sigma_{mu} \times (I_{tr})_{uncracked}}{h}$$

Modulus of elasticity of composite,

$$E_c = E_m V_m + E_r V_{rl} \quad [5]$$

The curvature of section just before cracking,

$$\phi_A = \frac{M_{cr}}{E_c \times (I_{tr})_{uncracked}} \quad [6]$$

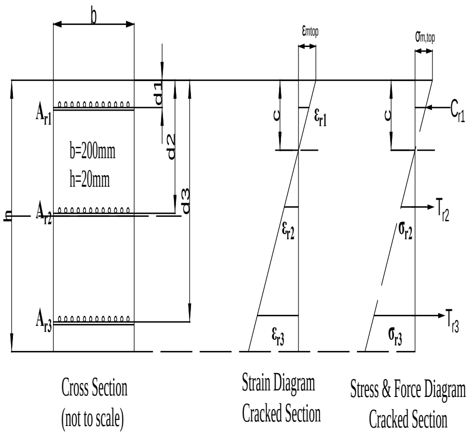

Figure1: C/s of panel with linear strain and linear stress diagram

b) Determine the Maximum Service Moment and Corresponding Curvature:

Transform the section into an all-mortar matrix. Assume the neutral axis of bending of the transformed section falls somewhere between the first and second layer of reinforcing mesh (trial and error). The neutral axis, c is obtained from the first moment of the section with respect to the neutral axis.

$$\Rightarrow (bc)\frac{c}{2} + (n-1)A_{r1}(c-d_1) = nA_{r2}(d_2 - c + nAr3\,d3 - c + nAr4\,d4 - c$$
[7]

Solving above equation, we get the distance of **neutral axis (c)** from the extreme fibre.

If the value of c indicate that the neutral axis of bending is in between the first and the second layer of mesh, i.e.,$d_1 < c < d_2$, as assumed. Otherwise, the assumption is revised and a second iteration is carried out. The moment of inertia of the transformed cracked section can then be obtained from:

$$\Rightarrow (I_{tr})_{cracked} = \frac{bc^3}{3} + (n-1)A_{r1}(c-3)^2 + n[A_{r2}(15-c)^2 + A_{r3}(27-c)^2] \quad [8]$$

Writing that the maximum stress in the extreme reinforcing layer is equal to the allowable stress, leads to:

$$\sigma_{r3} = n\frac{M(d_i - c)}{I_{tr}} = 210 \times 10^6 \quad [9]$$

$$M_{service} = \frac{210 \times 10^6 \times I_{tr}}{n(d_i - c)} \quad [10]$$

c) Determine the Maximum Compression Stress in the Matrix at Maximum Service Moment:

For, $M = M_{service}$, the stress in the extreme fibre is given by:

$$\sigma_{m,top} = \frac{M_{service} \times c}{I_{tr}}$$

d) Determine the stress in the other Reinforcing Layers at Maximum Service Moment:

$$\sigma_{r2} = n\frac{M_{service}(d_2 - c)}{I_{tr}} \quad [12]$$

$$\sigma_{r1} = n\frac{M_{service}(d_1 - c)}{I_{tr}} \quad [13]$$

If the value of stress is negative then the corresponding layer of mesh is in compression.

4.2. ANALYSIS OF FERROCEMENT PANELS (PLASTIC MOMENT METHOD):

Because a Ferro-cement section reinforced with multiple layers of reinforcement shows a very ductile behaviour, it can be assumed to behave as a perfectly plastic material with different properties in compression and in tension (fig.2). The properties in compression are assumed according to ACI rectangular stress block. The properties in tension are obtained from predicting the tensile resistance of the composite at yielding of reinforcement (σ_{cy}), that is all steel layers assumed to be in plastic range.

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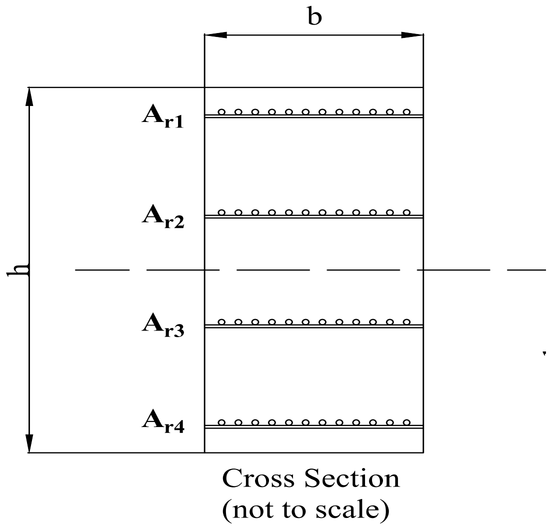

Figure 2: Assumed stresses in the section for computation of plastic moment

Referring to (Fig.2), the following equations can be written:

Compression: $C = 0.85f'_c ba$ [14]

Tension: $T = \sigma_{cy} b(h - a)$ [15]

$$\sigma_{cy} = \frac{\Sigma \eta V_{ri} A_c \sigma_{ryi}}{bh} \quad [16]$$

Here the summation is taken for all layers of reinforcement. The efficiency factor $'\eta'$ is taken should be taken for the direction of mesh resisting the load. By writing that $C = T$, the depth of plastic neutral axis $'a'$ is determined.

$$a = \frac{\sigma_{cy} h}{0.85f'_c + \sigma_{cy}} \quad [17]$$

Then the nominal moment or plastic moment is obtained from:

$$M_n = (C \; or \; T)\frac{h}{2} \quad [18]$$

4.3. ANALYSIS OF FERROCEMENT PANELS USING PREDICTION EQUATION:

Following an extensive computerized parametric evaluation of various ferrocement rectangular sections with different layers of meshes and different types of meshes, a non-dimensional regression equation and a corresponding design chart was developed by Naaman and Homrich and adopted in the ACI Guide for ferrocement Design, Construction and Repair. The graphical chart is given in (fig.3).

The X and Y ordinate are non-dimensional variables, valid in all systems of units and defined as follows:

$$X = \frac{V_r \sigma_{ry}}{f'_c} \quad [19]$$

$$Y = \frac{M_n}{\eta_o f'_c bh^2} \quad [20]$$

The regression equation for Y is given by:

$$Y = 0.0005 + 0.422X - 0.0772X^2 \quad [21]$$

It can be used in two different ways. First, graphically, that is, for a given X read the value of Y from the chart; second for a given X compute Y from equation [21].

For a given value of Y, equation [20] leads to:

$$M_n = \eta_0 Y f'_c bh^2 \quad [22]$$

It should be pointed out that this method applies only to rectangular sections with well distributed identical mesh reinforcing layers. It is less accurate when only two layers of mesh are used. Moreover, when the depth 'h' is replaced by the depth to the extreme tensile layer of reinforcement, 'd_e', and the value of $M_n$obtained is generally conservative.

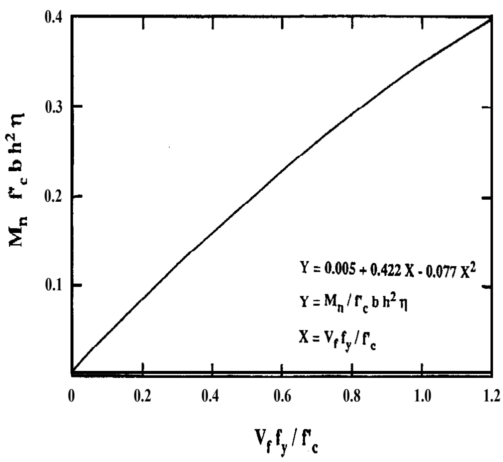

Figure 3: Chart for strength design of ferrocement in bending (ACI 549.1R-93)

V. RESULTS OBTAINED FROM ANALYTICAL STUDY:

The strength of mortar selected for the analysis were 30 MPa, 40 MPa & 50MPa. The thickness of panels was 20mm, 30mm & 40mm. The no. of reinforced mesh layers was 2, 3 & 4.

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The length of panels was taken as 600mm. The minimum clear cover should not be less than 3mm.

For Mortar strength of 30 MPa, 40 MPa & 50 MPa, the modulus of elasticity of panels are 20 GPa, 22 GPa, 24 GPa, respectively. From the analysis it can be observed that, with an increase in thickness of ferrocement panels and number of mesh reinforcement the bending strength, flexural strength & load carrying capacity increases. The flexural strength and ultimate loads depend on number of reinforcing mesh layers used in ferrocement panel.

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Table 1: Flexural Analysis Results by Transformed Moment Area Method

Mortar Strength (MPa)	**(h)**	**(N)**	$M_{service}$	**Load (N)**	σ_{r1}	σ_{r2}	σ_{r3}	$\sigma_{m,top}$
30	20	2	64.18	641.80	-28.23	-	-	7.93
		3	76.86	768.59	-42.05	83.97	-	9.61
		4	90.57	905.66	-53.15	40.83	116.02	10.95
	30	2	104.47	1044.66	-30.45	-	-	6.05
		3	124.48	1244.80	-41.89	84.05	-	7.34
		4	148.76	1487.57	-51.19	35.87	122.94	8.38
	40	2	145.07	1450.70	-29.70	-	-	5.08
		3	172.88	1728.77	-39.71	85.14	-	6.17
		4	208.27	2082.65	-47.91	35.53	126.56	7.07
40	20	2	64.46	644.57	-25.29	-	-	8.33
		3	77.51	775.09	-38.61	85.69	-	10.11
		4	91.57	915.74	-49.36	43.27	117.37	11.54
	30	2	104.78	1047.78	-28.03	-	-	6.36
		3	125.28	1252.83	-39.03	85.49	-	7.72
		4	150.02	1500.20	-48.00	38.00	124.00	8.83
	40	2	145.42	1454.23	-27.59	-	-	5.34
		3	173.83	1738.30	-37.20	86.40	-	6.49
		4	209.78	2097.76	-45.09	37.44	127.47	7.44
50	20	2	64.71	647.09	-22.71	-	-	8.71
		3	78.10	780.98	-35.57	87.21	-	10.58
		4	92.49	924.90	-45.99	45.43	118.57	12.10
	30	2	105.06	1050.61	-25.91	-	-	6.65
		3	126.01	1260.08	-36.51	86.74	-	8.08
		4	151.16	1511.62	-45.18	39.88	124.94	9.25
	40	2	145.74	1457.44	-25.74	-	-	5.59
		3	174.69	1746.88	-35.00	87.50	-	6.79
		4	211.14	2111.40	-42.61	39.12	128.27	7.79

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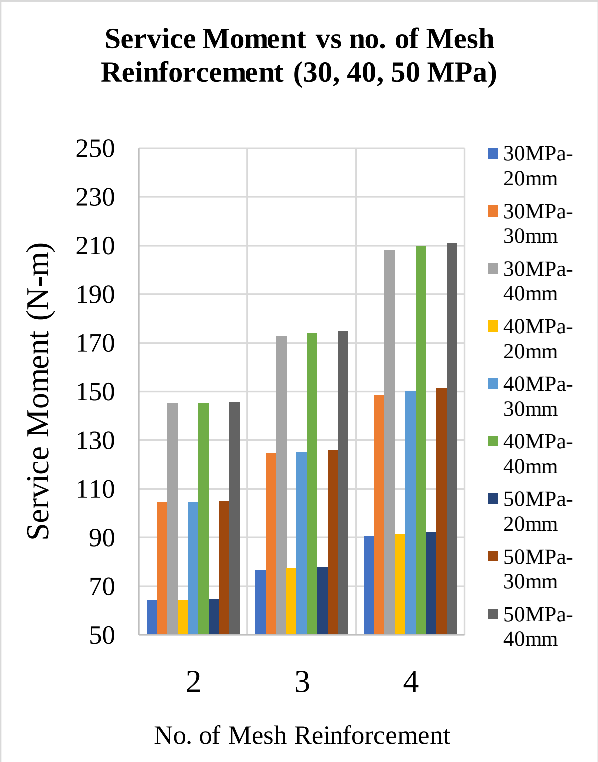
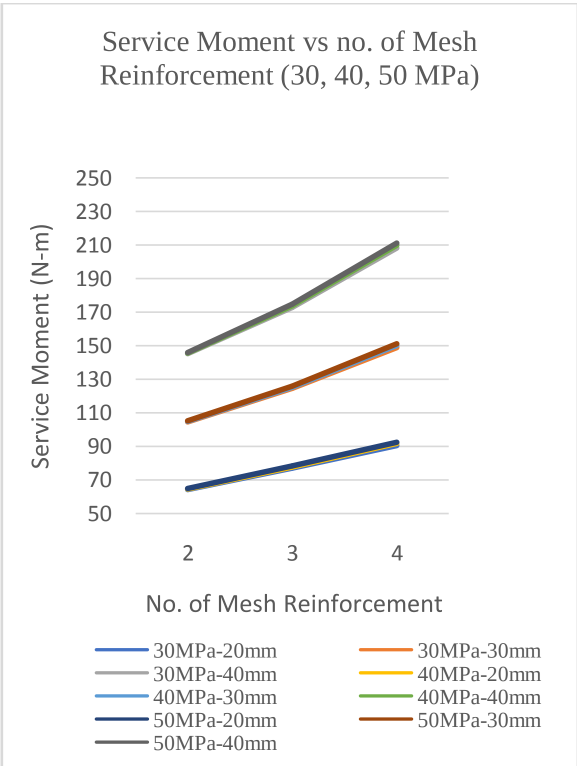


Graph 1: Service Moment vs No. of mesh layers (Moment Area Method-30, 40, 50MPa)



Graph 3: Service Moment vs No. of mesh layers (Moment Area Method-30, 40, 50MPa)

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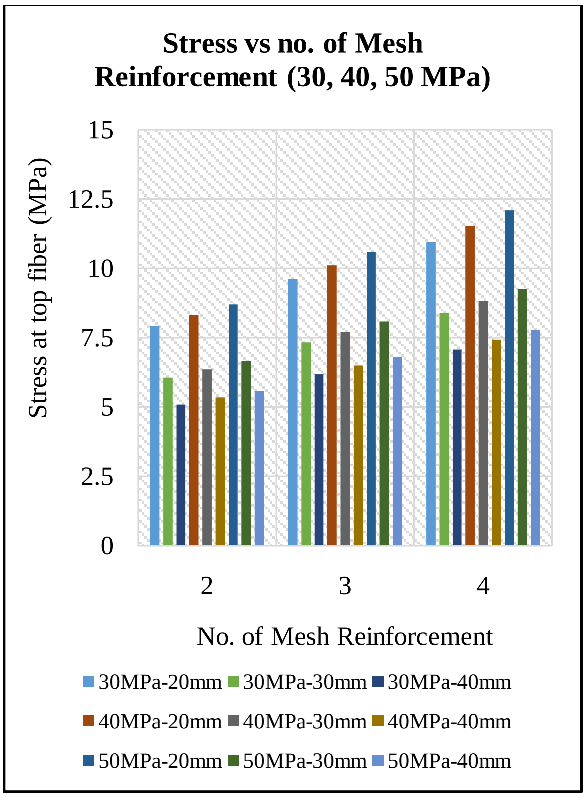
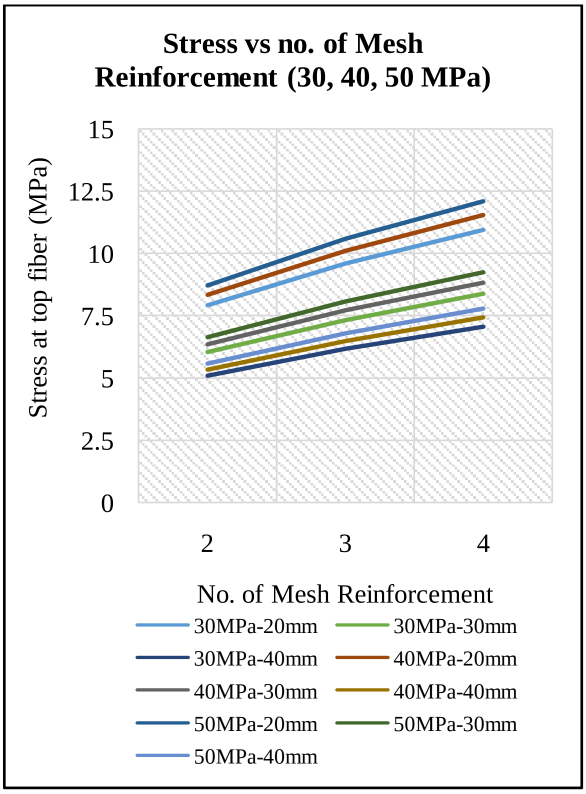


Graph 2: Flexural Strength vs No. of mesh layers (Moment Area Method-30, 40, 50MPa)



Graph 4: Flexural Strength vs No. of mesh layers (Moment Area Method-30, 40, 50MPa)

VI. DISCUSSIONS:

The ferrocement panels were analysed by three different methods (i) Moment Area Method (ii) Plastic Moment Method (iii) Graphical Method.
27 panels were analysed by each method having varying parameters.
The varying parameters were (i) no. of mesh layers (ii) thickness of panels (iii) mortar strength. No. of mesh layers used were 2, 3 & 4. Thickness of panels for the analysis were 30mm, 40mm, 50mm. Mortar Strength used were 30MPa, 40MPa, 50MPa.

From moment area method, service moment, stress at top and at subsequent mesh layers, curvature of the section for the cracked & uncracked section can be calculated while from Plastic Moment Method and Graphical Method only nominal moment can be calculated and by using flexural formula, stress at top fibre can be calculated. Also, Moment Area Method is the most accurate method among these methods. There is significant difference between the results obtained from Moment Area Method and Plastic Moment Method or Graphical method.

From the analysis it can be observed that, with an increase in thickness of ferrocement panels and number of mesh reinforcement the bending strength, flexural strength & load carrying capacity increases. The flexural strength and ultimate loads depend on number of reinforcing mesh layers used in ferrocement panel.

- Increasing the number of layers of wire mesh from 2 to 4 layers significantly increases the moment & and ultimate load carrying capacity of the panels. Because by increasing number of mesh layers, we are increasing the tensile strength of the panels.
- With an increase in number of mesh reinforcement, there is considerable increment in stress induced at top fibre of the matrix.
- The thickness of ferrocement panels significantly influences the stress induced & flexural strength of ferrocement panels. With an increase in thickness of ferrocement panels from 20mm to 40 mm there is significant increase in flexural Strength of panels, because moment of inertia increases with an increase in thickness of panels and thus increasing the moment carrying capacity.
- The stress induced in top fibre decreases considerably with an increase in thickness of ferrocement panels but with an increase in number of mesh layers there is a considerable increment in the stress induced at top fibre.
- There is almost negligible effect on the bending strength of ferrocement panels with an increase in mortar strength from 30 MPa to 50MPa. But with an increase in mortar strength the flexural strength of panels increases considerably.
- With an increase in mortar strength from 30MPa to 40MPa, the bending strength increases by less than 1% and by increasing mortar strength from 40MPa to 50MPa, the bending strength increase by less than 0.5%. Hence it can be concluded that by increasing the mortar strength there is almost no effect on the bending strength of ferrocement panels.
- By increasing the mortar strength from 30MPa to 40MPa, the flexural strength increases by approximately 5% and by increasing the mortar strength from 30MPa to 50MPa, the flexural strength increases by almost 10%.
- For ferrocement panels with 30MPa mortar having 4 layers of mesh reinforcement, the stress induced at third layer increases by 9.1% by increasing the thickness of panels from 30mm to 40mm.
- For ferrocement panels with 40MPa mortar having 4 layers of mesh reinforcement, the stress induced at third layer increases by 8.60% by increasing the thickness of panels from 30mm to 40mm.
- For ferrocement panel with 4 layers of mesh reinforcement, there is negligible effect of increasing mortar strength on stress induced at third layer of mesh. The stress induced at the third layer increases by only 1% by increasing the mortar strength from 30MPa to 40MPa and it increases by only 2% by increasing the mortar strength from 30MPa to 40MPa.
- For ferrocement panels with 50MPa mortar having 4 layers of mesh reinforcement, the stress induced at third layer increases by 8.18% by increasing the thickness of panels from 30mm to 40mm.
- With an increase in the number of mesh layers, the flexural strength of panels increased by approximately 20% & with an increase in thickness of ferrocement panels from 20mm to 30mm, the flexural strength increased by approximately 63% while increasing the thickness of panels from 30mm to 40mm the flexural strength increased only by 40% (approximately).
- If the mesh reinforcement is provided at the neutral axis, then there is no effect in the

uncracked moment of inertia of ferrocement panels.

- For the analysis using prediction equation and plastic moment method, this method applies only to rectangular sections with well distributed identical mesh reinforcing layers. It is less accurate when only two layers of mesh are used.
- From the graph it can be pointed out that there is a liner relationship between the properties of ferrocement panels with the number of mesh layers or thickness of panels.
- If volume fraction is kept constant and by changing the thickness and number of mesh reinforcement, the bending strength of the panels increases significantly.
- For 20mm thick panel with 2 layers of mesh having volume fraction of 0.0205, the bending strength increases by almost 225% by increasing the thickness and mesh layers of panel from 20mm to 40mm and 2 to 4 layers respectively.
- For a given volume fraction of reinforcement, better performance-not in terms of strength, but in terms of crack widths, watertightness, and ductility-can be achieved by uniformly distributing the reinforcement throughout the thickness and by increasing its specific surface. While for certain applications, a minimum of two layers of mesh would be acceptable, the advantages of ferrocement are mostly realized when more than two layers are used.

VII. CONCLUSIONS

1. Mortar Strength (30MPa):

a) For 20mm thick panels with M30 mortar, when the number of mesh layer increases from 2 – 4 the flexural strength increases by 38.10%.

b) For 20mm thick panels with M30 mortar, when the number of mesh layer increases from 2 – 4, the bending strength increases by 41.1%.

c) For 30mm thick panels with M30 mortar, when the number of mesh layer increases from 2 – 4, the flexural strength increases by 38.5%.

d) For 30mm thick panels with M30 mortar, when the number of mesh layer increases from 2 – 4, the bending strength increases by 42.4%.

e) For 40mm thick panels with M30 mortar, when the number of mesh layer increases from 2 – 4, the flexural strength increases by 39.17%.

f) For 40mm thick panels with M30 mortar, when the number of mesh layer increases from 2 – 4, the bending strength increases by 43.6%

2. Mortar Strength (40MPa):

a) For 20mm thick panels with M40 mortar, when the number of mesh layer increases from 2 – 4 the flexural strength increases by 38.53%.

b) For 20mm thick panels with M40 mortar, when the number of mesh layer increases from 2 – 4, the bending strength increases by 42%

c) For 30mm thick panels with M40 mortar, when the number of mesh layer increases from 2 – 4, the flexural strength increases by 38.84%.

d) For 30mm thick panels with M40 mortar, when the number of mesh layer increases from 2 – 4, the bending strength increases by 43.2%

e) For 40mm thick panels with M40 mortar, when the number of mesh layer increases from 2 – 4, the flexural strength increases by 39.33%

f) For 40mm thick panels with M40 mortar, when the number of mesh layer increases from 2 – 4, the bending strength increases by 44.3%

3. Mortar Strength (50MPa):

a) For 20mm thick panels with M50 mortar, when the number of mesh layer increases from 2 – 4 the flexural strength increases by 38.92%

b) For 20mm thick panels with M50 mortar, when the number of mesh layer increases from 2 – 4, the bending strength increases by 42.9%.

c) For 30mm thick panels with M50 mortar, when the number of mesh layer increases from 2 – 4, the flexural strength increases by 39.10%.

d) For 30mm thick panels with M50 mortar, when the number of mesh layer increases from 2 – 4, the bending strength increases by 43.9%.

e) For 40mm thick panels with M50 mortar, when the number of mesh layer increases from 2 – 4, the flexural strength increases by 39.36%

f) For 40mm thick panels with M50 mortar, when the number of mesh layer increases from 2 – 4, the bending strength increases by 44.9%

VIII. FUTURE SCOPE

- Similar type of work can be done by changing the diameter of mesh wire.
- Similar type of analysis can be done by changing spacing between the wires or grade size.
- Similar types of panels can be tested under impact test loading.
- The panels can be tested experimentally to validate the analytical results.

- Experimental investigation can be done on ferrocement panels by using different types of fibres. (Polypropylene Fibres, Steel Fibres, etc.)

8. REFERENCES

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