

Ferrocement Material for Construction

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Abstract : Ferrocement Is A Composite Material Used To Form Thin Section, It Is Composed Of A Mortar, Reinforcement Includes Light Steel Fabrics And Meshes. Ferro Cement Originated In The 1840 In France And After This A Reinforced Concrete Was Invented. Ferro Cement Cover The Wide Range Of Applications Due To The Low Self Weight, Economic, Lack Of Skilled Workers, No Need Of Frame Work Etc.

It Covers Series Of Advantage As Compare To Reinforced Concrete Such As:

- I) A Wider Range Of Electricity.
- ii) Greater Resistance To Extension.
- iii) Better Behavior At Dynamic Stress.
- iv) Increased Value Of The Breaking Effort Out Of Extension.

Ferro Cement Is Suitable For The Construction Of Roofing/Floor Elements, Precast Units, Manhole Covers, And Construction Of Domes, Vaults, Grid Surface And Folded Plates. It Can Also Be Used For Making Water Tanks, Boats, And Silos. Prefabricated Elements Are Used In Construction Industry As An Alternative System To Overcome The Formwork Problems In Addition To Getting Better Quality Control. The Prefabricated Elements Made Of Reinforced Concrete Are Extremely Heavy And Difficult To Transport, Placing In Position And To Construct. Alternatively, Ferrocement Panels Are Being Used In Construction Industry Due To Its Good Structural Performance And Low Cost. This Paper Concludes That Ferrocement Can Be A Best Suitable Material In Upcoming Years With A Large No Of Applications. In This Paper Review Work Is Presented On Ferrocement As A Construction Material And Its Properties

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I. INTRODUCTION

Ferrocement 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 Which May Be Made Of Metallic Or Other Suitable Materials. Since Ferrocement Possess Certain Unique Properties, Such As High Tensile Strength-To-Weight Ratio, Superior Cracking Behavior, Lightweight, Mold Ability To Any Shape And Certain Advantages Such As Utilization Of

Only Locally Available Materials And Semi-Skilled Labor/Workmanship, It Has Been Considered To An Attractive Material And A Material Of Good Promise And Potential By The Construction Industry, Especially In Developing Countries. It Has Wide Range Of Applications Such As In The Manufacture Of Boats, Barges, Prefabricated Housing Units, Biogas Structures, Silos, Tanks, And Recently In The Repair And Strengthening Of Structures. Ferrocement Is Suitable For Low-Cost Roofing, Pre-Cast Units And Man-Hole Covers. It Is Used For The Construction Of Domes, Vaults, Grid Surfaces And Folded Plates. It Can Be Used For Making Water Tanks, Boats, And Silos. Ferrocement Is The Best Alternative To Concrete And Steel. Generally, Ferrocement Shells Range From 10 Mm To 60mm In Thickness And The Reinforcement Consists Of

Layers Of Steel Mesh Usually With Steel Reinforcing Bars Sandwiched Midway Between. The Resulting Shell Or Panel Of Mesh Is Impregnated With An Extraordinarily Rich (High Ratio Of Cement To Sand) Portland Cement Mortar. Ferrocement Is A Highly Versatile Construction Material And Possess High Performance Characteristic, Especially In Cracking, Strength, Ductility, And Impact Resistance

Properties Of Ferrocement

Ferro Cement Is A Type Of A Reinforced Concrete Having Large Amount Of Smaller Diameter Wire Meshes Are Needed, These Wires Are Metal Wire And Sometimes Other Type Of Suitable Material Can Be Used Sand, Cement, Mortar Mix And Quantity Of Reinforcing Material Decide The Strength Of Ferro Cement.

II. MATERIALS:

The Following Materials Are Used In This Work:

- 1) Ordinary Portland Cement (43 Grade)
 - 2) Fine Aggregate
 - 3) Chicken Meshes-Hexagonal Opening
 - 4) Water
 - 5) Steel According To The Design
 - 6) Binding Wire
 - 7) Admixtures
- 1) **Cement:**

Ordinary Portland Cement (I.S.I. 269-1976) -
Some Of The Properties Of The Cement Are:

Specific Gravity = 3.15, Standard Consistency = 34%, Initial Setting Time = 40mins

Compressive Strength = 52.16 N/Mm²

2) Fine Aggregate:

Fine Aggregate Used Are Passing Through 4.75 Mm Is Sieve With A Specific Gravity Of 2.62

3) Chicken Mesh:

Galvanized Chicken Wire Mesh With A Hexagonal Opening Of Size 12mm And A Wire Thickness Of 1.29mm Is Generally Used.

4) Water:

Potable Drinking Water Was Used For Mixing And As Well As For Curing Other Constituent Elements Are As Follows:

5) **Steel** – Generally The Diameter Of Steel Used Is From 3 Mm To 10 Mm But Generally 6 Mm Diameter Steel Is Most Commonly Used.

6) **Binding Wire** – Binding Wire Of 18 To 24 Gauge Is Used.

7) **Admixtures** – For Increasing The Workability, Minimizing Water Use And Reducing The Setting Time Of Cement Admixtures Are Added.

Equipments Required For Ferrocement Construction

- 1 Nails
- 2 Hammer
- 3 Plumb Bob
- 4 M.S.Plane
- 5 Steel Cutter
- 6 Chisel
- 7 Wire Brush
- 8 Spade
- 9 Showel
- 10 Sieve
- 11 Wheel Barrow

III. METHODOLOGY

The Ferrocement Construction Is Done In Four Parts As Bellows

- 1 Fabrication Of Reinforcement Cage
- 2 Preparing The Mortar
- 3 Plastering
- 4 Curing

1 Fabrication Of Reinforcement Cage

a) Steel Cage

Generally M.S. Steel Is Used For The Cage. The Spacing Between Vertical And Horizontal Steel Is Kept As 7.5 Cm And 30 Cm. The Overlap Of Steel Is 15 To 30 Cm For Binding Of Steel G.I. Binding Wire Is Used.

b) Chicken Mesh

Galvanized Chicken Mesh Is To Be Bind To Cage With The Help Of Gi Binding Wire. As Per Requirement Chicken Mesh To Be Binded In

Two To Eight Layers. The Chicken Mesh To Be Binded Tightly On Cage. The Overlap Of One Layer To Other Is Minimum 2 Feet.

2 Preparing The Mortar

The Proportion Of Cement And Sand Is 1:2 Or 1:3. The Water Cement Ratio Is 0.4. Admixtures To Be Added If Required. First Dry Mixing Of Cement And Sand Is To Be Done And Water To Be Added As Per Requirement In Mix.

3 Plastering

Plastering Is Very Important Before Plastering M.S.Steel And Chicken Mesh Cage Is To Be Checked To Be Properly Tied. The Best Method Is To Do By Hand Plastering. In The Second Method The Plastering From Inner And Outer Side Is To Be Done.

In The First Method The Internal And External Portion To Be Done Simultaneously.

In The Second Method The Plastering Of Internal Portion To Be Done First And The Plastering Of Outer Side To Be Done Secondly. After Plastering Within Two To Three Days Finishing Being Done. The Plastering Layer Of 2 Mm Tk To Be Done Over The Steel Reinforcement.

4 Curing

Curing Is Very Important For Ferrocement Work. The Curing For The Completed Ferrocement Work To Be Done After 24 Hours. The Curing To Completed Work To Be Done For Minimum 14 Days And Maximum Up To 21 Days. If The Continuous Water For Curing Is Not Available Use Jute Bag And Keep The Jute Bag Wet So That The Work Will Get Water For Curing.



Ferrocement material



Ferrocement material



Ferrocement cage fabrication



Ferrocement applying mortar

IV. THE EXPENDITURE FOR MATERIAL & LABOUR FOR 100 SQM

Sr.No	Particular	Qty	Rate in Rs/	Amount
1	MATERIAL			
a	Chicken mesh two layer ½ "x ½" (2 x 100 m2 +10% extra for joints)	220 sqm	72/sqm	15840
b	Steel 6 mm tk	176 kg	38/kg	6688
c	Binding wire G.I.18 gauge	2 kg	40/kg	80
d	Sand sieved	2.5 cum	780/cum	1950
e	cement	30 bags	300/bag	9000
f	Admixtures	30 kg	50/kg	1500
g	Water	600 kg		600
2	LABOUR			
a	Helper labour	3 days	100/day	300
b	skilled labour	6 days	100/day	600
c	Mason	3 days	300/day	900
d	welding	Lump sum		800
			Total	38258
			Rs/sqm	382.58
			Rs/sft	35.56

Repair And Maintaince

For Ferrocement Construction Maintaince Is Very Less. But Due To Heat And Some Mistakes Remains There Is A Chance Of Developing Minor Cracks In Ferrocement Work But Such Small Cracks Will Not Affect The Workability Of Ferrocement. But If The Cracks Are Bigger Then Repair Is Required .Care Is Required To Be Taken For The Ferrocement Work To Be Workable. Proper Curing Of The Completed Work Is Essential For 21 Days Also It Is To Be Kept Safe From Impact And Extreme Sunlight.

Uses Of Ferrocement

- 1 For Water Tank
- 2 Boat
- 3 Toilet
- 4 Kitchen Otta
- 5 Biogas Plant
- 6 Roof Of Houses
- 7 Grain Store
- 8 Geodesic Dome
- 9) Low Cost Dwelling House
- 10) Strengthening Reinforced Concrete Element.

- 11) Strengthening Masonry Element.
- 12) Marine
- 13) Agricultural
- 14) Anti Corrosive Membrane Treatment
- 15) Tank Container & Silos
- 16) Floor & Roof



Uses of ferrocement



Uses of ferrocement



Uses of ferrocement



Uses of ferrocement

V. CONCLUSION

Ferro Cement Can Increase The Capacity Of All Existing Element, With No Regards On The Grade Of Concrete. Ferrocement Perform Good Against Lateral Displacement, Fire Resistant Etc Economically Without Required Any Skilled Worker.

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