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# EXPERIMENTAL STUDIES ON STRENGTH OF FERRO-CRETE BY USING STEEL MESHES IN SPECIMENS

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**Abstract –** *Due to the rapid urbanization and rise in the cost of construction material demand of low cost housing project are significantly increased. Just to lower down the cost of construction, it is essential to prefer locally available material at the same time it must compatible to the local condition. It helps to improve quality of the building as well as living condition. To achieve these goals Ferro-Crete as a construction material considerably attract attention of the engineers and industry toward itself. Ferro cement possess the high tensile strength with respect to weight ratio. Ferro-Crete has a higher cracking behavior comparing over reinforced cement concrete. It is used construct build structure in many shape, thin, hard and strong surface. This paper is basically focuses on experimental investigation of ferrocrete, comparing the ferrocrete with the reinforced concrete material. For the current project work lot of research paper is referred and studied some of the important highlights are mentioned here. It consists of closely spaced mesh in a multiple layers embedded in the cement. Orientation of the mesh is also changed and studied experimentally.*

***Key Words***: Ferro Cement1, wire mesh2, ferro-crete3, fibre reinforced concrete

## 1.INTRODUCTION

Ferrocement is relatively new material, it was first used in Europe in the middle of nineteenth century, generally used in dockyard for the building of sheep's. Latter on is also significantly used in construction industry just to satisfy the different architectural improvements.

Ferrocement has an advantage over other types of repairs and strengthening techniques because it is made through a non-formwork construction process.

Ferrocement which may be crafted from non – formwork creation method is a bonus over different form of upkeep and strengthening techniques. It complements the crack resistance blended with excessive toughness. This fabric affords a cost-powerful answer for rehabilitation and widespread packages with the aid of using implementing a small more weight at the structures.**1.1 What is ferrocement?**

Ferrocement, also known as ferro-cement, is a building method in which a "armature" consisting of woven expanded metal or metal fibres, thin steel rods placed tightly apart, and metal mesh is covered in reinforced mortar or plaster (lime or cement, sand, and water). Steel or iron are the most often utilised metals. Usually, a 3:1 ratio of highly rich cement to sand is used to make the cement; however, while building boats, no gravel is added, making the material non-concrete.

### 1.2 Project methodology 2

We are incorporating 1.5 micron pebbles into the ferroement. The steel mesh that we are utilizing can easily accommodate aggregates of this size. This kind of aggregate is added to the concrete in order to strengthen it more compressively. Since this is an experimental endeavor, the addition of this aggregate type to ferrocement is purely exploratory and is only being done to test the compressive strength.

## 2. Literature Review

**Kute et.al (2013)** investigated how wire mesh orientation affected ferrocement. The study's conclusion is that, for both horizontal and vertical orientations of hexagonal mesh, the compressive strength of ferrocement increases with an increase in the total volume fraction of reinforcement (%) and specific surface of reinforcement (mm2/mm3). Transverse orientation of reinforcement, or orientation perpendicular to the axis of loading, offers a higher compressive strength than vertical orientation, or orientation parallel to the axis of loading.

**P.N. Balaguru et.al.** this paper corresponds to The mortar matrix primarily used in Ferro cement consists of hydraulic cement and inert filler material. Portland cements generally used, sometimes blended with a pozzolan. The filler material is usually well graded sand capable of passing a 2.36 mm sieve. However, depending up on the characteristics of the reinforcing material (mesh opening, distribution, etc.); a mortar containing some small-size gravel may be used. The physical properties and microstructure of mortar depend on the chemical composition of the cement, the nature of the sand, the water-cement ratio, and the curing conditions of the finished product. Since the matrix represents approximately 95 percent of the Ferro cement volume, its propertieshave a great influence on the final properties of the product.

**Sumesh jain et.al.(2014)** The demand for affordable housing projects is on the rise, mainly because of

urbanization. Building materials should be appropriate for the local conditions in order to improve the quality of life of the most needy people by constructing new structures and improving existing ones. Ferrocement as a building material has attracted considerable attention in the research community, practice, and industry. It has excellent uniformity characteristics compared to r.C. Because cement is thin, it can be used as an alternative to wood, steel, and asbestos cement. Expected to be low level technology.

**Mohamad N. MahmoodSura A. Majeed** conducted an experimental work to study the bending behavior of flat and folded ferrocement plates. The bend-tested panels measure 380 mm x 600 mm and 20 mm thick for both flat and folded panels. The wire mesh used was a square galvanized welded mild steel wire mesh with a diameter of 0.65 mm and a mesh size of 12.5 mm. The authors conclude from their experimental studies that the crack loading was not significantly influenced by the number of wire meshes, especially for folded panels. The study also concluded that the bending strength of folded panels increased by 37 percent and 90 percent for panels with two and three wire mesh layers, respectively, compared to a single layer. On the other hand, for the flat slab, the increase in flexural strength using 2 and 3 is 65% and 68%, respectively, compared to the simple mortar slab.Indian scientist by the name Dr. T. Chandrasekhar Rao, Dr. T.D. gunneswara Rao and Dr. N.V. Ramana Rao, Ch. Rambabu done An Experimental Study On Ferrocement Box- Beams Under Flexural Loading (September 2012), and come with the following results As the volume of reinforcement increases an increase in the cracking and ultimate moment capacity is observed in solid and cored box-beams. Cores reduced the weight by about 11.8%; while ultimate load reduction is only 7.7% compared to solid box-beams with two layers of wire mesh. In the case of beams with four layers of wire mesh the reduction in the ultimate load is found to be 6.6% .

**Waleed A. Thanoon, M.S. Jaafar , M. Razali , A. Kadir and J. Noorzaei** have studied the structural behaviour of cracked reinforced concrete one-way slab, which was repaired using different techniques. It could also be concluded that all repairs techniques like grouting, epoxy injection and ferrocement layers etc. were used effective to at least restore the structural performance of cracked reinforced concrete slabs.

## 2. Work done

During the project tenure all the experiments are carried out, following are entities mentioned below.

Property Avg. Value of OPC Used in Present Investigation. Standard Value for OPC

| | | |
|---|---|---|
| Consistency (%) - | 28.85 | |
| Initial Setting Time | - | 38 min ≥30 min |
| Final Setting Time | - | 560 min≤600 min |
| Soundness | - | 3 mm <10 mm |

Properties of aggregate are given below

| Property | Fine | Coarse |
|---|---|---|
| Fineness Modulus | 1.99 | 4.837 |
| Specific Gravity | 2.62 | 2.85 |
| Water Absorption (%) | 0.55 | 1.0 |
| Bulk Density (Kg/m3) | 1.31 | 1.47 |

With PCC, there is no need to lay steel mesh. However, our project requires steel mesh to make reinforced concrete. To investigate the difference in strength between ferrocrete and his PCC, steel nets with different arrangements are inserted into the mold during filling. To insert the steel net, the mold must be half filled and properly compacted. Then hold the steel net horizontally, leaving 20 mm of cover on all sides. In the case of a vertical net, push the net vertically into a half-filled mold, and in the case of a diagonal arrangement, push the net diagonally so that the mesh is free, covering about 20 mm from all sides, filling the mold and compressing it. To do. I'm shaking. For beams, pour a single layer of 20mm concrete and compact it. Next, insert the U-shaped net and completely fill the mold, leaving 20 mm of cover from the top. Next, a layer of mesh is inserted and the mold is completely filled and compacted.

**Fig -1**: Wire mesh arrangement 1

**Fig -2**: Wire mesh arrangement 2

**Fig -3**: Wire mesh arrangement 3

**Fig -4**: Wire mesh arrangement 4

Tests were performed on 36 cubes and 18 beams with different steel grid arrangements and curing times of 7, 14, and 28 days.

The use of steel mesh in reinforced concrete not only increases the tensile strength, but also affects the compressive strength. It can definitely improve the crack resistance of reinforced concrete.

This type of concrete is also known as fiber concrete. However, fiber-reinforced concrete fibers are not continuous fibers, but small fiber pieces. Similar to reinforced concrete, continuous mesh layers are laid.

The tests conducted showed that depending on the placement of the steel mesh within the concrete, the properties of the concrete were significantly improved.

The number of layers placed in the concrete also affects the strength of the concrete. The use of mesh types also affects the strength of reinforced concrete.

**Table -1:** Number of strength cube

| Arrangement of Steel Mesh in Cubes. | No. of Cubes for Testing. | | |
|---|---|---|---|
| | 7 Days | 14 Days | 28 Days |
| PCC ( No Mesh ) | 03 | 03 | 03 |
| Horizontal Mesh | 03 | 03 | 03 |
| Vertical Mesh | 03 | 3 | 03 |
| Diagonal Mesh | 03 | 03 | 03 |

**Table -2:** Compressive strength of cube (N/mm$^2$)

| | **7 Days** | **14 Days** | **28 Days** |
|---|---|---|---|
| PCC | 12.69 | 15.11 | 21.85 |
| Horizontal Mesh | 10.90 | 14.21 | 18.83 |
| Vertical mesh | 15.39 | 17.09 | 25.24 |
| Diagonal mesh | 13.08 | 15.95 | 19.81 |

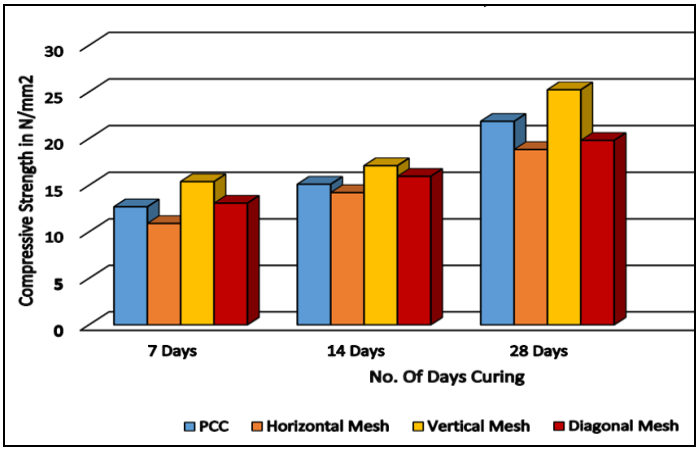


**Chart -1**: Comparison of different mesh arrangement

## 3. CONCLUSIONS

It is often observed that the maximum increase in compressive strength is achieved when the reinforced concrete mesh is placed vertically compared to PCC cubes and all other cubes.

On the other hand, when the cubic mesh is placed horizontally, the compressive strength is lower than that of the PCC cube.

We also see that in the diagonal configuration, the cube increases slightly in the 7-day and 14-day tests, while the strength decreases in the 28-day test.

The overall increase in compressive strength of the cube when the net is placed vertically compared to the PCC cube is approximately 21% for the 7-day test, 13% for the 14-day test, and 16% for the 28-day test Increased.

The overall compressive strength increase for cubes with diagonal mesh arrangement was approximately 3.1% for the 7-day test and 5.6% for the 14-day test, whereas for the 28-day test, the compressive strength compared to the PCC cube was Shockingly reduced to 9%.

However, for the horizontal arrangement, the compressive strength results are consistently negative, and it is concluded that the horizontal arrangement of the network is not suitable for the compressive strength.

When testing bending strength, the mesh placement is completely different. The mesh is placed as a separate mesh in a "U" shape, leaving 20 mm of coverage on all three sides.

It can be observed that the bending strength of the beam samples increases significantly compared to the PCC beam samples.

We observe an increase in 7-day testing, 14-day testing, and 28-day testing to be 40%, 25%, and 20.5%, respectively.

From the overall data, it can be concluded that a vertical arrangement for compression tests and a U-shaped arrangement for bending strength tests can increase the strength of the structure.

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