International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 05 Issue: 01 | Jan-2018 www.irjet.net p-ISSN: 2395-0072

USE OF FERROCEMENT AS CONSTRUCTION AND REPAIRING MATERIAL

Prof. Varsha V.Bhatewara[1], Mr. Dhananjay G. Ahire, Prof. Nikita G.Agrawal[3]

[1]Assistant Professor, SVKM Institute of Technology, Dhule.
[2]Technical Trainee at Varsha Constructions Pvt Ltd, Dhule.
[3]Lecturer, SSVPS BSD Polytechnic, Dhule.

ABSTRACT - The main objective of this research is to evaluate the capability of Ferro cement for strengthening un-reinforced brick masonry columns and to make this process of retrofitting effective, economical and easy for practice. It had been concluded from this study how Ferro cement is better than conventional types RCC, PCC etc. and perform good against lateral displacement, fire resistant etc. economically without any skilled worker. On other hand ferrocement is a good alternate materials depending upon location of application.

KEYWORDS- Ferrocement, PCC , Brick Masonry.

1. INTRODUCTION

Ferrocement is a type of thin reinforced concrete wall commonly constructed of hydraulic cement mortar reinforced with closely spaced layers of continuous and relatively small size wire mesh Ferrocement a composite material of steel and cementitious material is an ingenious invention of mid 19th century which has a good potential for use in a wide variety of applications. Ferrocement is a thin construction element with thickness in the order of 10-25mm and uses rich cement mortar, no coarse aggregate is used, and the reinforcement consists of one or more layers of continuous/small diameters steel wire`/weld mesh netting. It requires no skilled labour for casting and employs only little or no formwork. In ferrocement, cement matrix does not crack since cracking forces are taken Cover by wire mesh reinforcement immediately below the surface.

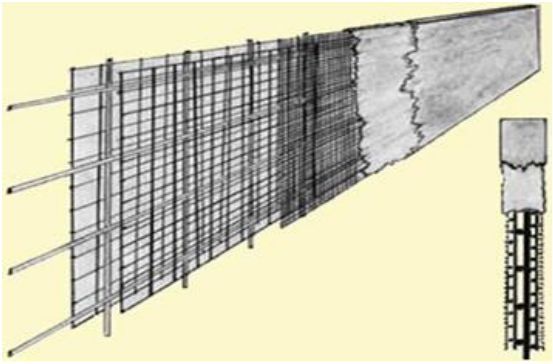


Fig). CROSS SECTION OF FERROCEMENT STRUCTURE

It can be used to build the wide range of structures, can be worked mainly by unskilled, though supervised, labour. Throughout the world, highly satisfactory fishing boats, pleasure crafts , storage tanks , housing components & sorted agricultural , commercial facilities have been constructed of ferrocement. Its use is increasing rapidly.

2. BACKGROUND

In this modern era of construction, there is an urgent need to explore a building material that is urgent need to explore a building material that is structurally efficient. Ferrocement is being explored as building materials substituting stone, brick, rcc. steel, prestressed concrete and timber and also as structural components-walls, floors, roofs, beams, columns and slabs, water and soil retaining wall structures; other applications include window and door frames and shutters. Ferrocement can be fabricated into any desired shape or structural configuration that is generally not possible with standard masonary, rcc or steel. There are many structures built of ferrocement-housing units, shell roofs, water tanks and swimming pools, biogas digestors,silos, food storage units, and for some specialized applications such as floating marine structures for which reinforced concrete is too heavy, ferrocement is a preferred choice over reinforced concrete.

Ferrocement uses layers of continuous /small diameter steel wire/weld netting (metallic or non metallic) as reinforcement with high volume fraction of reinforcement (2 to 8%) and the specific surface of reinforcement is considerably high for ferrocement than for rcc. Also, the reinforcing steel wire mesh has openings large enough for adequate bonding, the closer distribution and uniform dispersion of reinforcement. Steel wire meshes are considered the primary mesh reinforcement. This include the various types of the shape ; square woven or welded meshes, chicken wire mesh, expanded metal mesh lath etc.Except for expanded metal mesh , generally all the meshes are used galvanized.

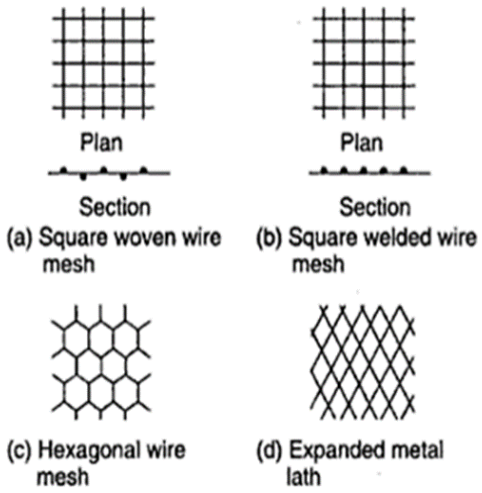


Fig) TYPES OF REINFORCING MESHES

3. EXPERIMENTAL INVESTIGATION

To carry out investigation, 30 number of columns of size 220x220x300mm were casted. Out of these 30 number of columns, 15 columns were casted of 1:2 proportion and 15 columns were casted of 1:3 proportion. In these 15 columns, 3 number of columns were casted of plain bricks i.e plain brick column, 6 number of columns were plastered brick columns and remaining 6 were of ferrocement brick column. Ferrocement brick columns were encased with steel reinforcing mesh of 24 gauges and then plastered with cement mortor. Then these columns were cured for 7 days and 28 days. Then the compressive strength of all the columns was tested under the compression testing machine after curing for 7 days and 28 days respectively.

Fig 1). CASTING OF BRICK COLUMN

Fig 2). PLASTERING TO FERROCEMENT

Fig 3). CURING OF COLUMNS

4. RESULTS AND OBSERVATIONS

Fig 1) TESTING OF PLAIN BRICK COLUMN

Fig 2) CRACKING OF PLASTERED BRICK COLUMN(1:3)

Fig 3) CRACKING OF PLASTERED BRICK COLUMN (1:2)

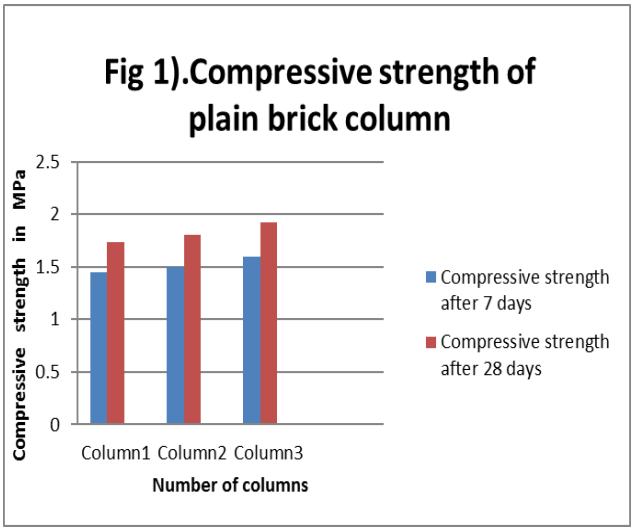
Fig 4) CRACKING OF FERROCEMENT COLUMN (1:2)

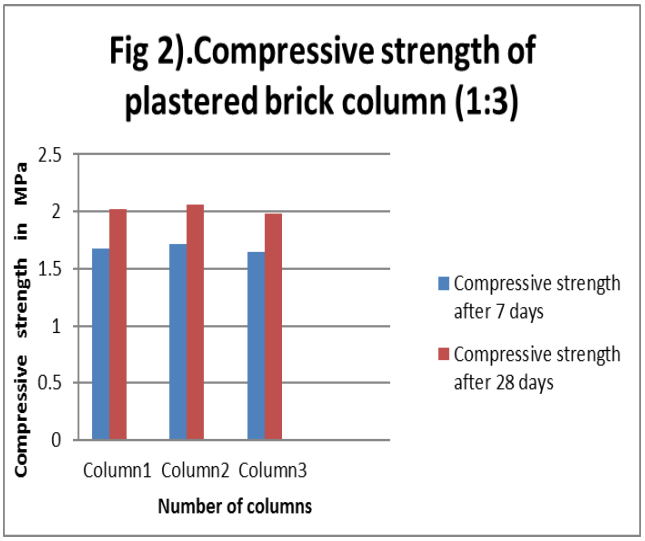
4.1. OBSERVATIONS TABLE NO. 1

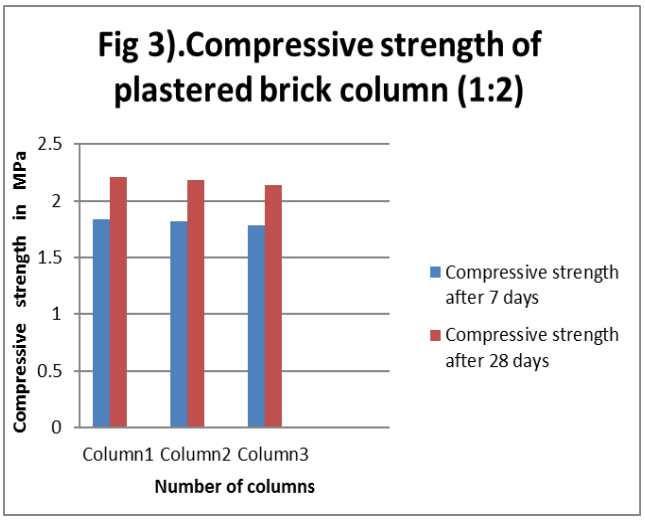
Type of column	Compressive strength after 7 days (tons)	Compressive strength after 28 days (tons)
1. Plain brick column (22cmx22cm)	1. 7.15 2. 7.4 3. 7.89	1. 8.58 2. 8.93 3. 9.47
2. Plastered brick column (24cmx24cm) (1:3)	1. 9.86 2. 10.1 3. 9.7	1.11.83 2.12.02 3.11.64
3. Plastered brick column (1:2)	1. 10.80 2. 10.7 3. 10.45	1.12.74 2.12.73 3.12.53
4. Ferrocement column (24cmx24cm) (1:3)	1. 13.62 2. 13.4 3. 13.50	1.15.93 2.15.68 3. 16.06
5. Ferrocement column (1:2)	1. 14.38 2. 14.09 3. 14.56	1.16.82 2.16.34 3.17.2

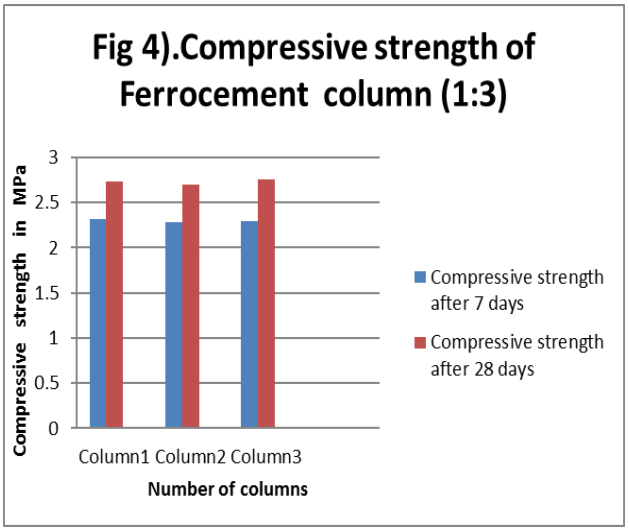
4.2 OBSERVATION TABLE NO.2

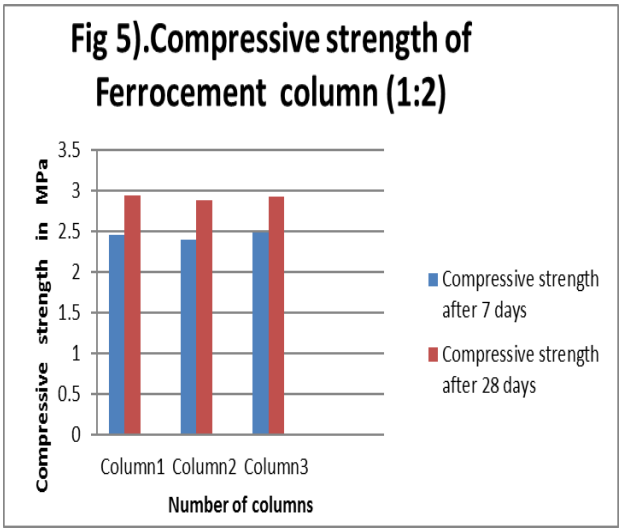
Type of column	Compressive strength after 7 days (MPA)	Compressive strength after 28 days (MPA)
1. Plain brick column	1. 1.45 2. 1.5 3. 1.6	1.1.74 2. 1.8 3. 1.92
2. Plastered brick column (1:3)	1.1.68 2. 1.72 3. 1.65	1. 2.02 2. 2.06 3. 1.98
3. Plastered brick column (1:2)	1. 1.84 2. 1.82 3. 1.78	1. 2.21 2. 2.184 3. 2.14
4. Ferrocement column (1:3)	1. 2.32 2. 2.28 3. 2.30	1. 2.74 2. 2.70 3. 2.76
5. Ferrocement column (1:2)	1. 2.45 2. 2.4 3. 2.48	1. 2.94 2. 2.88 3. 2.93











6. CONCLUSION:

The test results analysis led to the following conclusions.

1. Encasement of unreinforced brick masonry columns by ferrocement doubles the failure load.

2. Average crack spacing reduces with reduction in spacing of wire.

3. Premature failure is possible if mesh is not properly wraped and plaster does not fully penetrate into it.

4. Mortar strength has comparatively smaller influence on failure load.

5. Ferrocement casing can be used to repair un-collapsed column which have been loaded close to failure, provided it is possible to relieve them of major portion of load.

6. Clear cover to reinforcement shall not be greater than 2mm and for each 6 mm thickness of ferrocement casing one layer of reinforcement may be satisfactory.

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