

Study on Analysis of Behaviour of Hybrid Ferrocement Slab with Different Layer of Welded Square Mesh under Monotonic Loading

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ABSTRACT:Compositematerials,including Steelbars with welded mesh,have been gaining momentum as an alternative to traditional steel reinforcement in civil and structural engineering sectors. In this paper, the preliminary tests such as compressive strength, split tensile strength, and modulus of elasticity for steel bar concrete were carried out. This study analysis the behaviour of ferrocement concrete slab reinforced with various layer of welded square mesh and Steel rebars subjected to Monotonic vertical loading using ABAQUS.

KEYWORDS:Ferrocement Slab,Welded Square meshes, Monotonic Load,ABAQUS

I. INTRODUCTION

In the past few decades, various new construction materials and techniques have evolved in the construction industry. In this context, it becomes necessary to throw light upon ferrocement which is almost as old as reinforced concrete, an effective and durable construction material. Though the concept of ferrocement is not new, its real development and utilization has been significant only in recent years. It is increasingly being put to numerous applications including construction of new structures and rehabilitation of existing structure. Ferrocement is widely used in marine, terrestrial and housing applications. Owing to its water tightness, thin walls, light weight and impact resistance it is used in the construction of boats, floatation buoys, docks and barges. It is also used in the construction of water tanks, sedimentation tanks, bus shelters, grain storage bins, silos, biogas digesters, etc. The housing applications of ferrocement include construction of water tanks, precast wall panels, roof panels, sandwich panels,

hollow core slabs, sunscreens, repair and rehabilitation of existing housing elements.

WELDED SQUARE MESH

Welded mesh are a quick and efficient method of improving security. The company provides high quality welded mesh with galvanized finish thus making it ideal for metal fencing. It is so designed as to withstand harsh weather conditions. The welded mesh is put to variety of uses:

- Used as machinery guards in the factories
- Used as racking and storing in warehouses
- Used for the plants and creepers in the garden
- Used for making feed racking system, rearing cages etc in farming

FERROCEMENT

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". The mesh may be made of metallic and suitable materials. In the words of Nervi who first used the term ferrocement its notable characteristics is "Greater elasticity and resistance to cracking given to the cement mortar by the extreme subdivision and distribution of the reinforcement"

II. METHODOLOGY

MIX DESIGN

Mix Design can be defined as the process of selecting ingredients of concrete and determine their relative proportions with the object of producing concrete of certain minimum strength and durability as economically as possible. The object of any mix proportion method is to determine an

economical combination of concrete constituents that can be used for a first trial batch to produce a concrete that is close to that which can achieve a good balance between the various desired properties of concrete at the lowest possible cost.

The mix design methods being followed in different countries are mostly based on empirical relationships, charts and graphs developed from extensive experimental investigations. The various methods available are ACI mix design method, USBR mix design method, British mix design method and Indian Standard method. In this study mix design was done as per Indian Standard guidelines in IS:10262-2009.

PREPARATION OF MOULD AND CASTING OF SPECIMEN;

The Steel Cylinder mould was oiled before casting and mortar was prepared by exact amount of cement and sand by weighing. Before casting reinforcing bar are cut into required number of pieces. While casting a specimen a spacer of height 30 mm and 25 mm are used. The grooves are provided to spacer for maintaining appropriate distance between the meshes. Also bottom and top of spacer is help to maintaining proper cover to cylinder. At first cement and sand mixed dry. After dry mixing add water and admixture in dry mix. Cement mortar are placed in mould with reinforcement. Specimens were demoulded after 24 hours and allow in curing tank for 28 days.



EXPERIMENTAL INVESTIGATION

In order to know the mechanical behaviour of ferrocement concrete specimens were casted and tested. The 7 days & 28 days water cured ferrocement concrete specimens were tested for mechanical properties such as compressive strength, split tensile strength tested. Mechanical behaviour of ferrocement concrete specimens were studied with the help of conducting compression, split tensile tests

Load Vs Deflection Test On Cylinder

The Load Vs Deflection test is carried out for the cylinder to check whether the young's modulus of M25 grade ferrocement concrete. The trial mix for cylinder with the dimension of 150x300mm is casted and allow for curing. The test is carried out for 7 and 28 days of casting.



The Load Vs Deflection of cylinder is shown in Fig



SPLIT TENSILE TEST ON CONCRETE CYLINDER

The experiment was performed in accordance with IS: 516 -1959 (Reaffirmed 1999). A standard test cylinder of 300mm length and 150mm diameter plain concrete cylinder was used for this test. The split tensile strength of cylinder is given below in Table

Specimen	Split tensile strength (N/mm ²)	
	7days	28days
1	3.43	4.38
2	3.57	4.44
3	3.59	4.56

PARAMETER CONSIDER FOR THE STUDY

Slab Size = 1000x500x30mm

CONCRETE

Young's Modulus of Ferrocete = 33600N/mm²

Poisson's Ratio of Cocrete = 0.23

HYSD SREEL BAR

Diameter of Main Reinforcement = 8mm

Diameter of Distribution Reinforcement = 6mm

Young's Modulus Of HYSD steel bar = 2x10⁵N/mm²

Poisson's Ratio Of HYSD steel bar = 0.28

SQUARE MESH

Open Size Of Welded Square Mesh = 25x25mm

Diameter Of Welded Square Mesh = 1.2mm

Volume Of Fraction = 1.09

ANALYSIS

Analysis procedure

➤The section was created based on the centre line dimensions.

➤The material properties like young's modulus, Poisson's ratio, yield stress were defined and assigned to the sections.

➤ Then sections were assembled together using part instance.

➤The section was converted into a finite element model by using mesh module.

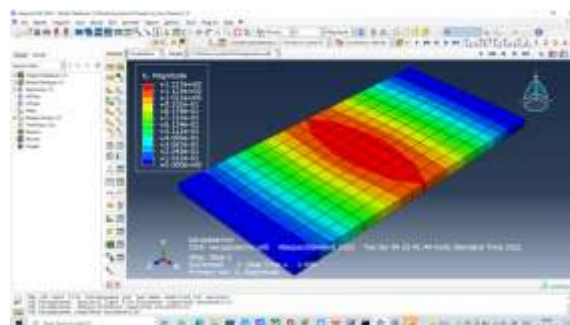
➤The reference points and constraints were created at both the ends.

➤Then the boundary conditions were defined at both the ends based on the support condition.

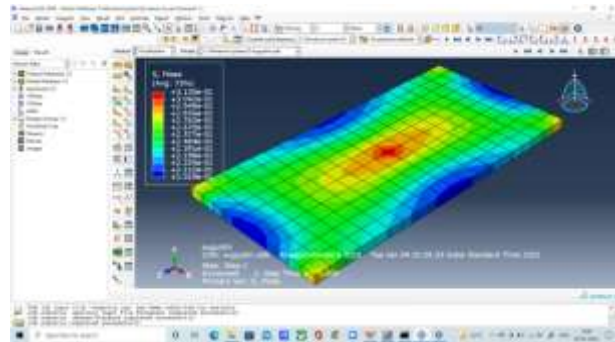
➤ Unit load was applied at reference point.

➤Then the ferrocement slab analysis was performed and deformed mode shape was obtained.

➤Then the non-linear analysis was performed and values are obtained.

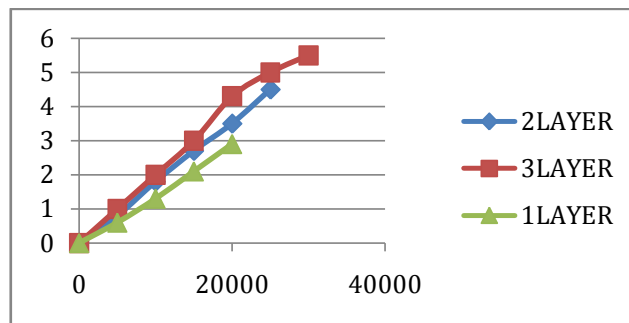


a) Displacement of Ferrocement slab with Square meshes



b) Stresses of Ferrocement slab with Square meshes

COMPARISON OF FERROCEMENT SLAB DEFLECTION WITH VARIOUS LAYRR OF MESHES



C) Comparison of load Vs deflection in various layer of mesh slab

One layer FC Slab		Two layer FC Slab		Three layer FC Slab	
Load	Deflect	Load	Deflect	Load	Deflect
0	0	0	0	0	0
5000	0.6	5000	0.8	5000	1
10000	1.3	10000	1.8	10000	2
15000	2.1	15000	2.7	15000	3
20000	2.9	20000	3.5	20000	4.3
		25000	4.5	25000	5

III. CONCLUSION

- 1.The raw materials required for the casting of Cylinder were collected and preliminary testing have been done.
- 2.Different layer meshes of cylinder specimens were cast and their compressive strength, split tensile strength have been found at the end of 7th day.
- 3.ABAQUS 6.13 is a software suitable for finite element analysis. It can be used to analysed the different layer meshes of slab for under monotonic loading.
- 4.The values of displacement , stresses, moments are obtained from the software analysis.

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