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Analysis and Behaviour of Ferrocement Slab with Different Layer of Chicken Mesh under Monotonicloading

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ABSTRACT: The structural performance of conventional ferrocement as a thin cementitious composites has been enhanced by using ferrocement slab with Various layer of chicken mesh. The method used to achieve high performance in deflection and strength capacity.In this phase, the preliminary test such as compressive strength, splite tensile strength and modulus of elasticity for ferrocement were carried out.Then Finite element modelling and analysis were carried out. The materialproperties of the ferrocement slab used in the model were from the obtained test data. The behaviour of ferrocement slab reinforced with chicken mesh and steel rebars subjected to a monotonic loading using ABAQUS 6.13.

KEYWORDS: Ferrocement ,Monotonic load, Chicken mesh ,Cement ,Load ,Deflection ,

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 structures.

Ferrocement is not to be seen only as a low cost material. An investigation of its performance, which showed high tensile strength due to meshes embedded in mortar, reveals that it can be used effectively for high quality construction. The use of advanced technologies can improve the applications of ferrocement as a high quality, durable and cost competitive construction material .

Ferrocement has a high tensile strength and high modulus of rupture. Its tensile strength can be of the same order as its compressive strength. It has a high specific surface of reinforcement which is the same as or twice that of reinforced concrete. The greater surface area to volume ratio of reinforcement results in higher cracking strength for ferrocement. Ductility, which is an important characteristic of a structure to withstand an earthquake, increases with an increase in the volume fraction and specific surface of reinforcement, unlike reinforced cement concrete where lower ductility is observed with an increase in reinforcement ratio.

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.

II.LITERATUREREVIEW :

A) STUDY ON FERROCEMENT SLABWITH DIFFERENT MESHES FOR FLEXURE PUNCHING SHEAR - Banduke.K.V.a Prof. Narule G. N.b

Ferrocement is a form of reinforced concrete using nearly spaced multiple layer of galvanized iron wire mesh applying on frame of skeletal bar and completely infiltrated in rich cement mortar. It is durable and cheap material.

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The main objective of this experiment is to behavioural study on ferrocement slab under flexure loading and punching shear strength between chicken and square welded mesh. Also various parameters are effect of volume fraction, effect of panel thickness and load-deflection relationship considered in this study. Test result shows that specimen reinforced with square welded mesh gives high flexural strength and specimen reinforced with chicken mesh exhibit highest punching shear strength. Specimen with high volume fraction has highest stiffness but less ductility and increase in slab thickness leads to decrease in deflection and more stiffness.

The ferrocement slab having 30 mm depth reinforced with square welded mesh exhibits high 3.45 % and 1.47 % in flexural strength as compared to both slab reinforced with chicken mesh. The ferrocment slab having 25 mm depth reinforced with square welded mesh exhibits high 20.83 % and 21.74 % in flexural strength as compared to both slab reinforced with chicken mesh.

B)EFFECT OF USING DIFFERENT TYPES OF REINFORCEMENT ON THE FLEXURAL BEHAVIOUR OF FERROCEMENT HOLLOW CORE SLABS EMBEDDING PVC PIPES - Fatimah H. Naser , Ali Hameed Naser Al Mamoori , Mohammed K. Dhahir The effect of four different types of reinforcement was investigated in this study including; steel wire mesh, macro and micro steel fibers or a combination of both, steel bars and CFRP bars. Using wire mesh layers at the compression zone of thin hollow core slab considerably increases the ultimate flexural strength and stiffness of the slab when compared with that reinforced with wire mesh at the tension zone only. How-ever, and in general, slabs reinforced with wire meshes exhibit lower flexural strength and stiffness when compared with the other types of reinforcement.

Using PVC pipes as permanent hollow fillers has a consider-able effect on the flexural strength of hollow core slab, and significantly increases stiffness and ductility when com-pared with hollow core slabs without PVC pipes. In general, the addition of steel fibers to slabs with PVC pipes resulted in a significant increase in the ultimate failure load and stiffness when compared to that of the control slab, which is reinforced only with PVC pipes. This was attributed to the ability of steel fibers to arrest and delay the propagation of cracks within the slabs, and hence maintaining the integrity of the slab throughout the interval between the first crack and ultimate load stages.

III.MONOTONIC LOAD OF FERROCEMENT

SLAB : Ferrocement slabs are recommended for flooring and roofing units in earthquake prone areas since they have lesser self weight compared to reinforced cement concrete and hence attract lesser inertia force during an earthquake. Ferrocement has been widely accepted as a construction material for roof slabs, but only limited research has been done on the flexural behaviour of ferrocement slabs. A few investigations have been done on ferrocement slabs to study their behaviour under monotonic loading.

Structural elements of increased ductility have become an imperative need in the present scenario, especially after the revision of seismic maps in various countries. The researcher believes that it is important to study the performance of slab under earthquake loads. When these slabs are subjected to repetitive stresses as in cyclic loading, failure can occur at a load less than the failure value obtained for monotonic loading. Therefore an experimental investigation was carried out by the researcher on the behaviour of one way ferrocement slabs under one way monotonic loading to test whether these slabs can undergo large plastic deformation and absorb large strain energy

The slabs should be capable of withstanding any type of loading like point, seismic, wind load or operation of machinery in addition to conventional dead and live loads. Therefore, the ferrocement slabs were tested under monotonic loading. Their first crack strength, ultimate strength, deflections, curvature, propagation of cracks and the crack width, stiffness, ductility, toughness and energy absorption capacity under Monotonic loading were investigated.

IV.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.

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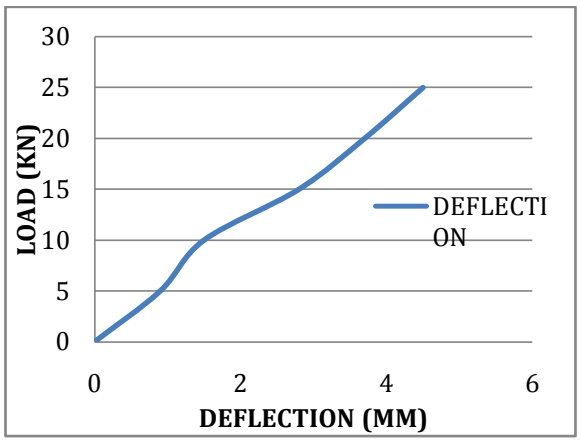
V.EXPERIMENTALINVESTIGATION :

In order to know the mechanical behaviour of ferrocement concrete specimenswere casted and tested. The 7 days & 28 days water cured ferrocement concrete specimensweretestedformechanicalpropertiessucha scompressivestrength,splittensilestrength tested. Mechanical behaviour of ferrocement concrete specimens were studied with the helpofconductingcompression,splittensile tests.


VI.LOAD VS DEFLECTIONON CYLINDER



Load Vs Deflection on cylinder one layer mesh

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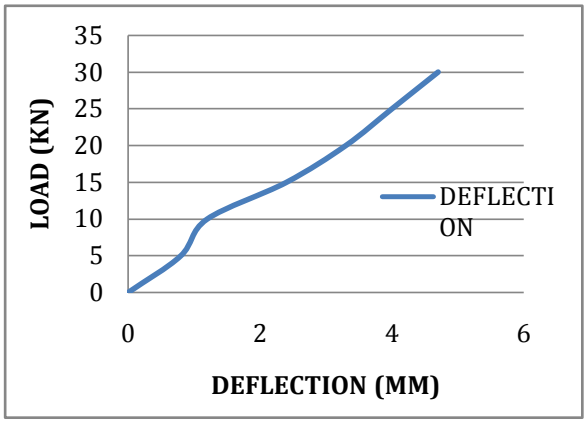
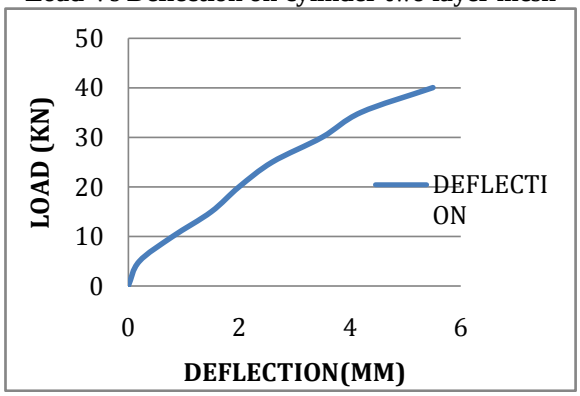


Load Vs Deflection on cylinder two layer mesh



Load Vs Deflection on cylinder three layer mesh

VII.ANALYSIS

A)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.

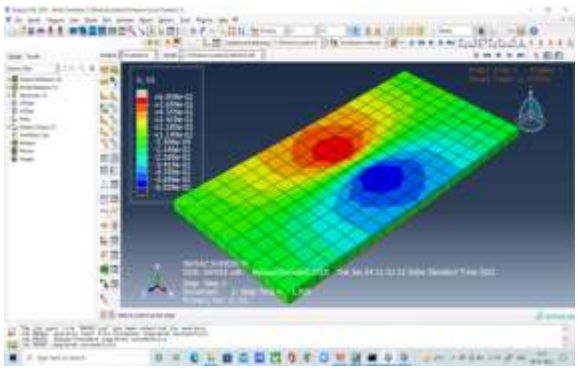
➢Unit load was applied at reference point.

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

➢ The analysis was performed and values are obtained.

B)OUTPUT RESULT

The analysis procedure were completed , the software analysis the ferrocement slab with data validation and give the output result.



Stress distribution of ferrocementslab with mesh

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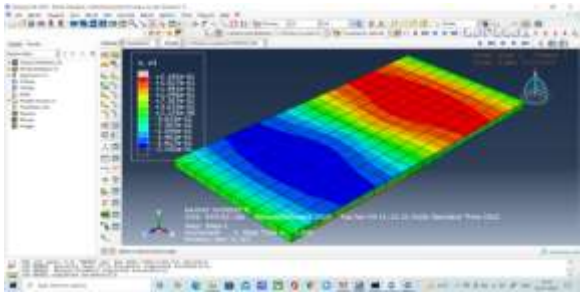
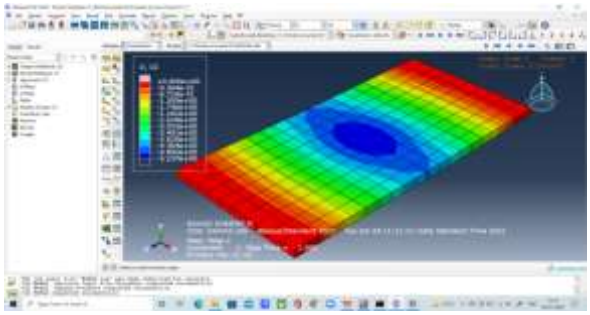
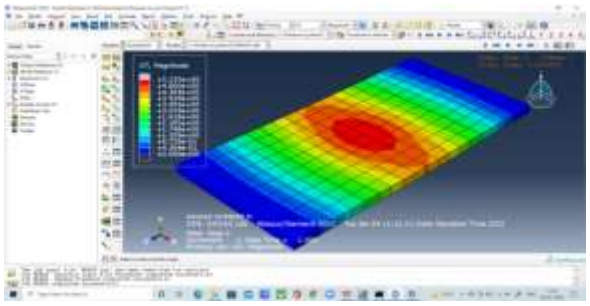


Stress distribution of ferrocementslab with mesh



Stress distribution of ferrocementslab with mesh

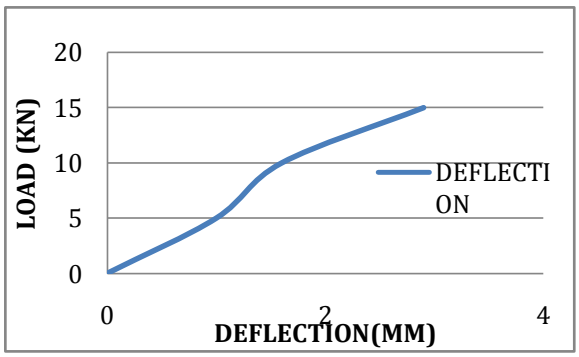


Deflection of ferrocement slab with mesh

C)SLAB WITH SINGLE LAYER OF MESH

Deflection on single layer of mesh slab

LOAD	DEFLECTION
0	0
5	1
10	1.6
15	2.9



Load Vs Deflection in single layer of mesh slab

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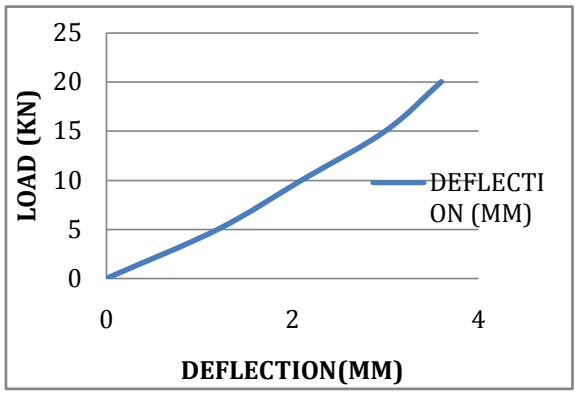
D)SLAB WITH TWO LAYER OF MESH

LOAD	DEFLECTION
0	0
5	1.2
10	2.1
15	3
20	3.6

Deflection on Two layer of mesh slab

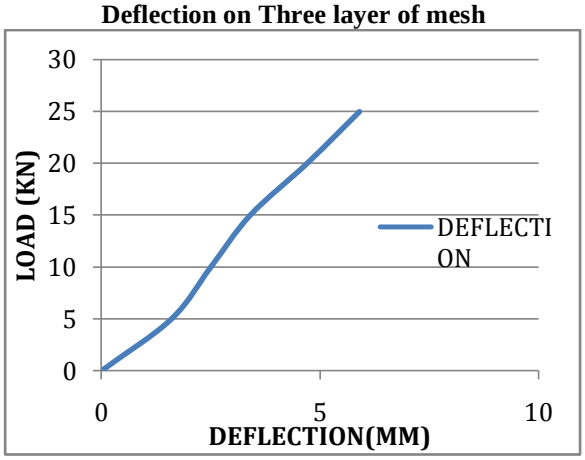


Load Vs Deflection in Two Layer of mesh slab

E) SLAB WITH THREE LAYER OF MESH

LOAD	DEFLECTION
0	0
5	1.6
10	2.5
15	3.4
20	4.7
25	5.9

Deflection on Three layer of mesh



Load Vs Deflection in three layer of mesh slab

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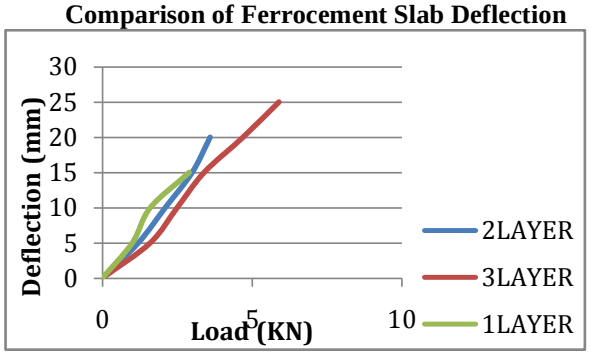
COMPARSION OF FERROCEMENT SLAB DEFLECTION WITH VARYING LAYERS OF MESH

ONE LAYER OF FC SLAB		TWO LAYER OF FC SLAB		THREE LAYER OF FC SLAB	
LOAD	DEFLECTION	LOAD	DEFLECTION	LOAD	DEFLECTION
0	0	0	0	0	0
5	1	5	1.2	5	1.6
10	1.6	10	2.1	10	2.5
15	2.9	15	3	15	3.4
		20	3.6	20	4.7
				25	5.9

Comparison of Ferrocement Slab Deflection



Comparison of Load VsDeflection

VIII.CONCLUSION

ABAQUS 6.13 is a software suitable for finite element analysis. It can be used to analysed the various layer meshes of slab for under Monotonic loading.The analysed result will be obtained from the ABAQUS software.

1) In comparing the variation of layers of mesh of the slabs, the slab with 3 layers of mesh is having more deflection with higher load carrying capacity compared to the other two slabs .

2)The deflection of slab with 3 layers of mesh is increased by 27% ,23% respectively when compared with the slab of one layer and two layer of mesh.

3)In comparing the variation of layers of mesh of the slabs, load carrying capacity of slabs is increasing with increase in the number of layers of mesh.

4)The slab with 3 layers of mesh is having higher load carrying capacity when compared to the other two slabs.

5)The load carrying capacity of slab with 3 layers of mesh is increased by 11% ,7.5% when compared with the slab of one layer and two layers of mesh.

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