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Shear Capacity of Ferrocement Plates

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I. INTRODUCTION

In order to reduce the in situ construction, now days the modernization and simplification of construction technology and building materials are preferred. The application of newly developed cement based composites for structural applications. Cement based composites perform better than conventional plain concrete.

A. Ferro Cement

Ferro cement is one of the relatively new cementations composite considered as a construction material. It is a type of thin walled reinforced concrete commonly consists of cement mortar reinforced with closely spaced layers of continuous and relatively small wire mesh .The closely-spaced and uniformly-distributed reinforcement in ferrocement, transformsthe otherwise brittle material into a superior ductile composite. Thus, Ferro cement has been regarded as highly versatile construction material possessing unique properties of strength and serviceability. Its advantageous properties such as strength, toughness, water tightness, lightness, durability, fire resistance, and environmental stability cannot be matched by any other thin construction material.[15] Ferro cement is the promising composite material for prefabrication and industrialization of the building industry.

However, as an alternative material ferrocement has not gained widespread acceptancein both; developed countries in general and developing countries in particular. Its acceptance is hindered mainly due to its small thickness and labour intensive method of production. The technical information available on the behaviour and strength of Ferro cement in shear is limited. The major variables of the study were the shear span-to-depth ratio, the volume fraction of the mesh wires, the strength of the mortar and the number of mesh wires near the compression face. It is a versatile form of a composite material made of cement mortar and layers of wire mesh or similar small diameter mesh closely bound together to create a stiff structural form. This material which is special from reinforced concrete, exhibits behaviour so different from conventional reinforced concrete in performance, strength and potential application that it must be classed as a separate material. The constituent material in ferrocement are cement , fine aggregate, water, reinforcing mesh of any type like hexagonal , square mesh, diamond mesh galvanised mesh, woven mesh etc.

B. Aim

The aim of this project is

1) To observe the behavior of ferrocement plates in shear by experimental analysisas well as FEM (Ansys) analysis.
2) Analyze the shear strength of the ferrocement plate with various mesh patterns

C. Objective

To observe the behavior of ferrocement plate when

1) Different mesh pattern are used having different volume fraction.
2) To determine the crack patterns under different loading conditions.
3) To determine the shear strength, shear stresses developed in ferrocementelement, shear cracking load of the specimen.
4) The stress intensity calculation using equations from literature and comparewith stress intensity obtained by FEM (Ansys)

D. Significance

The ferrocement elements such as beams, plates undergoes shear buckling ,which should be taken into account is the shear resisting mechanism, as the diagonal cracks that develop in thebeams are considerably wider than the flexural cracks and the abrupt failure without advancedwarning is distinctly different from the failure in flexure. Several attempts have been conductedto study the shear behaviour of ferrocement plates, beams were carried out. Although adequate design information and field experience have been acquired for many types of ferrocement structures, the shear behaviour is still questionable. Hence there is necessity to determine the shear strength of ferrocement element using the parameters like the number of mesh layers or volume fraction consequently lead to an increase of shear capacity.

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II. LITERATURE REVIEW

Researchers all over the world have studied and have testing procedure for calculating shear capacity of ferrocement material.It includes the work on different parameters like shear strength of ferrocement plates depends upon volume fraction of the mesh, load carrying capacity of ferrocement materials, specific surface of reinforcement. Investigation on different types of beams as well as plates. Hence by knowing the previous methods the research carried to analyze how the shear strength of ferrocement beams, plates depends upon the volume fraction. Following are literature reviews about different test conducted on plates and beams.

A. Literature Review On Plates

Mansur and Ong [18] studied the behaviour and strength of ferrocement in transverse shear. Tests were performed on ferrocement beams reinforced in tension and compression sides with layers of galvanized square wire mesh under four point load pattern. In a later study they reported test data and the behaviour of ferrocement plates and I Beams reinforced with wire mesh as a secondary reinforcement for web and flanges. The major variables of the study were the shear span-to-depth ratio, the volume fraction of the mesh wires, the strength of the mortar and the number of mesh wires near the compression face. Test results indicated that the diagonal cracking strength of ferrocement increased as the shear span-to-depth ratio was decreased and other parameters were increased. Empirical equations were proposed to predict the diagonal cracking strength of ferrocement. Ferro cement beams were found to be susceptible to shear failure at small shear span-to-depth ratios when the volume fraction of the mesh wires and the compressive strength of the mortar were relatively high.

Chandrasekhar [17] investigated the shear strength of simply supported ferrocement rectangular plates subjected to four points loading. Tested ferrocement elements with varying the shear span to depth ratio and different layers of mesh and they observed that the increase in the volume fraction of the mesh reinforcement (number of layers of mesh) will increase the shear capacity of the member. It is also found that up to shear span to depth ratio 3, shear behaviour is predominant. Beyond shear span to depth ratio 3, the flexural behaviour is predominant and design of the elements based on flexure is sufficient. The in-plane shear is important when ferrocement is used as wall panels or partitions in structures subjected to

III. METHODOLOGY

A. Schedule of the Project

Activity	Nov	Dec	Jan	Feb	Mar	April	May	June
Topic selection								
Collection of research paper								
Study of research paper								
Methodology								
Design of component								

Implementation								
Test result								
Conclusion								

IV. SUMMARY

This is the experimental analysis carried out of different mesh pattern. From the experimental analysis cracking pattern, cracking load at which the specimen fails, shear span of the plate, mortar compressive strength of concrete, nodal displacement of the plate is calculated. These parameters were used for analytical study.

V. RESULTS

Experimental Results

All the observed readings shows that at different loading condition deflection takes place in ferrocement plates and the final load at which the plate fails is recorded and the graph was plotted of each mesh. The graph consists of load v/s deflection. Then the combined graph of all mesh patterns was plotted. The crack patterns were observed for hexagonal, square mesh. Every care has been exercised to obtain the drooping portion of the load response of the testingspecimen during the testing. Loads that produced the initial crack and the ultimate load were recorded.

The load at which visible cracking has occurred was considered as cracking load. Following are the test results of all the specimens and graph is plotted of loading and deflection. All the experimental values are used for further analysis. Following tables shows the load at which deflection takes place for hexagonal (H), square mesh(S) plate. The size of plate is 490x230x20mm. The load and deflection for plain mortar plate is carried out as follows.

VI. CONCLUSION

After all the experimental and analytical analysis it is observed that shear capacity of ferrocement plates depends upon the volume fraction. The cracking and ultimate strength of plate depends upon the span to depth ratio of the plate. The important modes of failure in the ferrocement plates are web shear failure and flexure shear failure, from the failure modes the shear stresses that develops in the plate can be calculated using the equations from the availablecodes and literatures. From the available literature the volume fraction of plate, cracking shear strength, stress intensity of plate are determined and the values are compared with results obtained in FEM (Ansys) analysis.

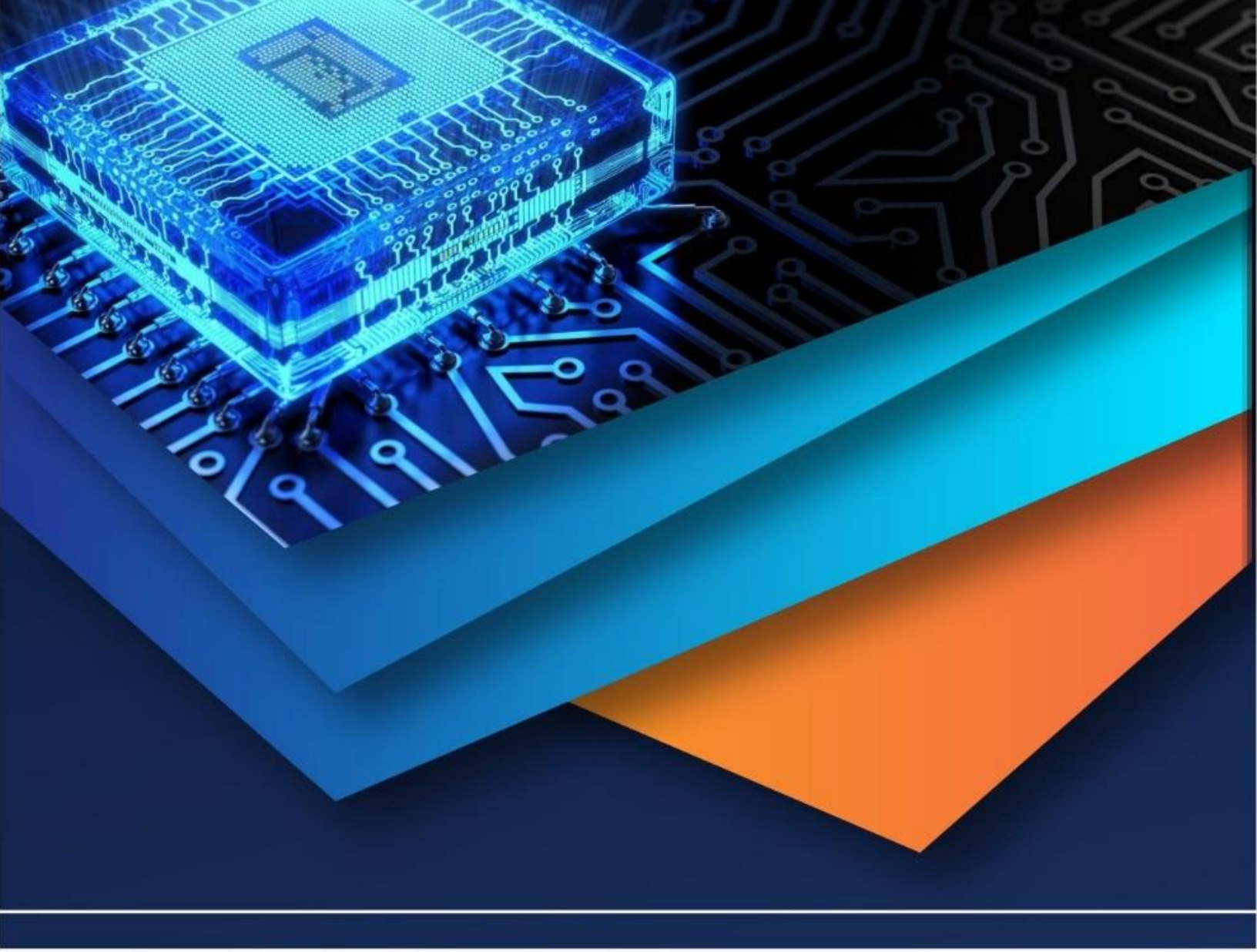
1) Two types of shear cracking and failure, namely, those due to flexure-shear & web- shear were observed.

2) The flexure shear cracking & flexure occurred at a lower shear stress than that at which the web-shear failure occurred for uniformly distribution mesh layout

3) Increasing the volume fraction of wire mesh layer subsequently increase the shear carrying capacity of the plate. To attain this advantage, supports and loading points shouldbe designed and strengthened to prevent local failure.

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