Study on Structural Behaviour of Earth Slab Panel Confined by G. I. Wire Mesh

(LOW COST HOUSING)

Shreya Ghosalkar
UG student of Vidyavardhini's College of Engineering & Technology
Mumbai university
Mumbai, India

Kushal Patel
UG student of Vidyavardhini's College of Engineering & Technology
Mumbai university
Mumbai, India

Abhishek Parmar
UG student of Vidyavardhini's College of Engineering & Technology
Mumbai university
Mumbai, India

Sandesh Uttekar
UG student of Vidyavardhini's College of Engineering & Technology
Mumbai university
Mumbai, India

Jaydeep Chogale
Assistant Professor at Vidyavardhini's College of Engineering & Technology
Mumbai university
Mumbai, India

***Abstract*— The aim of this research work was to demonstrate how an innovative low cost structure can be constructed by minimal alterations in the conventional methods of construction. It is a well known fact that abundant soil is naturally available. Therefore, this study investigates the use of Soil, Concrete and GI wire mesh to form a structure. This study introduces an economically affordable mode of construction by incorporating the use of soil as a filler material and GI wire mesh as reinforcement. According to this technique we came to know that about 65% of concrete use can be reduced and eliminating the use of steel for reinforcement. Thus, about 60% of cost reduction can be achieved.**

The slab panel constitutes of 25mm (greater than maximum size of aggregate) concrete lining on either sides in which the soil is been confined. The layer of G.I. sheet is embedded in both layers of concrete & is been connected with vertical tie ups with designed spacing. Based on the results obtained from Deflection test by using extensometer, the structural behavior of the slab panel can be assessed and its applicability in the construction industry can be studied.

Keywords—low cost, soil, G.I. wire mesh, confinement , earth slab panel,

I. INTRODUCTION

As we know that, Low Cost Housing has been a new concept & it deals with low budgeting and adopting techniques which will help in reducing the cost construction through the use of locally available materials along with improved skills and technology without losing the strength, performance and life of the structure. From past times it has been a misconception that low cost housing is suitable for only sub standard works and they are constructed by using cheap building materials of low quality. But the fact is that Low cost housing can be done by proper management of resources.

Building Cost: Usually the building construction cost is been divided into two parts i.e.:
1. Building material: 60%
2. Labour cost: 40 %

In our case, building material cost is less because we make use of the locally available materials. Reduction of cost can be achieved by selection of more efficient material &by an improved design.

Areas from where cost can be reduced using this technique:-

1) As the density of our earth slab panel has been reduced from 25 N/m3 to 20 N/m3thus it will reducing the dead weight of structure hence can be implemented where SBC of soil is low.
2) One can use locally available material like soil cement blocks in place of burnt brick for partition wall.
3) As the dead weight of structure is reduced considerably there is no need of strong foundations.
4) Use of TOR steel has been eliminated & hence cost of material can be saved .

II. LITERATURE REVIEW

There are various issues and construction strategies proposed for the Indian housing sector. Availability of building materials for construction and affordability of a

house are the main constraints on access to shelter. This paper analyzes the possibility of limiting the cost and practicing methodologies that can achieve minimum emissions. [2]

The Indian housing finance market (HFM) has been unsuccessful to promote housing development across the country.[3] This paper analyses the prominent issues confronting India's HFM. It offers policy alternatives to make the HFM more effective in addressing the hitherto neglected segment, the rural and less-developed region.

This study investigates the incorporation of the agricultural and industrial residue of rice husk ash into the cement-stabilized rammed earth system to recover the use of raw land as a sustainable construction material and provide low pozzolanicity content rice husk ash with a suitable end purpose. [1]

The material chosen to construct the structure of a building has the ability to reduce the building's initial environmental impact and its lifetime energy use. [4] In this paper, an substantial review of the ongoing construction practice of sustainable construction materials is summarized. Stability, Durability concerns and drawbacks of the methods of construction are discussed, and areas of future research are identified.

High crushing strength of bricks is achieved from its burning and the addition of cement, slag and lime enhances the load-bearing capacity of the blocks. [5]

The potential for improved thermal comfort by the addition of cement, lime, and slag additives is reviewed in this paper. The results show that minimum thermal conductivity coincides with the condition of maximum crushing strength. Thus, the strength achievable is not hampered to obtain minimum thermal conductivity. [6]

The current research emphasizes on the development of a split pin test method for determining the splitting strength of bamboo culms. The proposed test uses a full culm section test, thereby eliminating few complexities & limitations of partial culm tests. Results & conclusion of this study of the split pin test of similar specimens with different split pin diameters give consistent results and fluctuations less than that of the previously standardized direct shear test.[7]

III. METHODOLOGY

A. Collection of material

Soil- Soil which is used for the experiment purpose is locally available soil. Before performance of experiment soil was mm sieve. After initial testing the soil is classified to be poorly graded soil oven dried and sieved through.

Wire mesh- Wire mesh sheet is a highly versatile product which has a wide range of applications, from protective safety fencing, reinforcement to light fixtures etc.. Wire mesh can be made of carbon steel or stainless steel – with numerous varieties of hole sizes and gauges.Wire mesh is available in two types: woven type and welded type wire mesh. Mesh of welded type has been used for this project.

Concrete- Concrete is the most basic material used for construction which is a composite of cement, fine aggregates (sand) and coarse aggregates homogeneously mixed with water which hardens and sets with time. Portland cement is the most commonly used type of cement for concrete . Grade of concrete indicates its strength required for construction. For eg. we have used M60 grade concrete i.e. MPa strength concrete

B. Casting procedure

1. Fabrication of wire mesh

Wire mesh of size 2cm X 2cm for the experiment is used. As per the desired size of section two rectangular section for top and bottom confinement and also the strips of same for transverse reinforcement is prepared.

Fig.1 Fabrication of Wire Mesh

2.First layer of concrete

Desired thickness of panel section is 130 mm. Hence, casting of the bottom and top concrete layer of 30 mm each and rest of soil is to be done. Concrete is prepared of M60 grade for bottom layer. Bottom section of wire mesh is confined in to concrete while casting. The section is kept for curing for minimum 7 days.

Fig.2 Laying of first layer of concrete

3.Laying of earth

After the initial curing period gets over, soil layer of thickness 70 mm is laid. It is then hand compacted using a steel rod. Before placing the 2nd layer of concrete a cement slurry is sprinkled all over the soil to achieve proper bonding between concrete and soil.

Fig.3 Laying of filler material

4. Second layer of concrete

On the same day of laying soil, second layer can be casted. This layer is of same grade as 1st layer i.e. of M60 grade concrete. Also the top section of wire mesh is to be confined in concrete. Finishing is done. Section is again kept for curing for minimum 7 days.

Fig.4 Laying of second layer of concrete

C. **Testing procedure**

Panel is then tested for the deflection. Arrangements are made. 3 dial gauges are placed at mid section and near supports for measuring the deflection. Load of 4 KN/m2 was applied over the section uniformly.

Fig.5 Arrangement for testing

Fig.6 Loadi

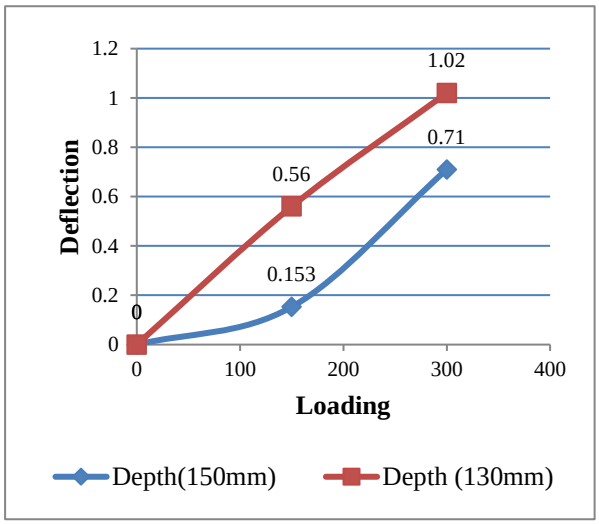
Fig.6 Loading & dial gauge arrangement

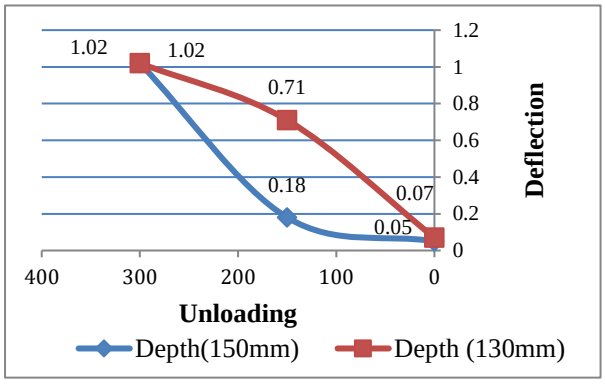
IV. RESULT TABLE & GRAPHS

Results of test obtained for sections with depth 150 mm & 130 mm are as follow:

Slab Section -1 (150 mm):						
Load in kg	Deflection in mm					
	Loading			Unloading		
	Dial gauge 1	Dial gauge 2	Dial gauge 3	Dial gauge 1	Dial gauge 2	Dial gauge 3
0	-	-	-	0.04	0.06	0.06
150	0.09	0.27	0.1	0.13	0.28	0.14
300	0.15	0.4	0.16	-	-	-

slab section -2 (130 mm):						
Load in kg	Deflection in mm					
	Loading			Unloading		
	dial gauge 1	dial gauge 2	dial gauge 3	dial gauge 1	dial gauge 2	dial gauge 3
0	-	-	-	0.06	0.09	0.08
150	0.12	0.31	0.13	0.18	0.037	0.21
300	0.21	0.56	0.25	-	-	-





DISCUSSION

On the basis of recent results, it is seen that the maximum permissible values of deflection for concrete slab is found out to be greater than the obtained earth slab results

V. CONCLUSION

Based on the results obtain, we conclude that the proposed technique of earth slab panel can effectively be used for upto G + 4 storey structure & is found out to be proficient for low cost housing.

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