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Filler slab with partial replacement of cement by Eggshell powder

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Abstract: ***Currently India has taken a major initiative in developing the infrastructure to meet the requirements of globalization in the construction industry. Considering building element like slab, more concrete is wasted in the tension zone, since the tensile forces are taken by the steel reinforcement. To overcome this wastage of concrete in tension zone, a new cost effective method called as Filler slab technique is used. Low price and lightweight filler substance like Mangalore tiles, that will decrease the dead weight in addition to the total cost of this slab to some degree. Being environmentally accountable, the utilization of waste substances is a Vital step in creating a sustainable future. The Eggshell, which is usually disposed as a poultry waste can be used as an alternate of cement in powdered form, since the shell is made up of Calcium having a chemical composition same as limestone. Partial replacement of cement by eggshell powder is done in different proportions like 2.5%, 5%, 7.5% & 10%. In this paper, the filler slab has been created additional cost effective with the addition of eggshell powder because partial replacement of cement. Following a healing period of 28 days, there's a version in compression and flexural strength of concrete using eggshell powder compared to conventional concrete.***

Keywords: ***Filler Slab Technique, Mangalore Tiles, Sustainable, Egg Shell Powder, Compression and Flexural Strength Of Concrete***

I. INTRODUCTION

Cement is thought of across the world one of the building materials. Cement is used as a binder. Cements used in building are generally inorganic, frequently lime or calcium silicate based. Greenhouse gas is emitted by the creation of cement both indirectly and directly. While leads to CO2 emissions to heat, the heating system of limestone sparks CO2 directly. The cement manufacturing contributes 5 % of the total carbon dioxide emission. Therefore increase in usage of cement leads to dramatically increased CO_2 emission, resulting to global warming. The usage of cement can be reduced by using certain organic wastes, which resembles the chemical composition and properties of cement. Within this paper, among the roofing methods that were economical known as filler slab procedure is embraced. The top region of the slab is exposed to compressive forces along with the lower portion of the slab encounter tensile forces. Concrete is quite great in resisting compressive steel and forces bears the load
as a result of tensile forces. Thus the decrease tensile area of the slab doesn't require any concrete except for holding the steel reinforcements together. Additionally the Filler slab additionally provides insulation in the hot climate beyond the construction, supplying thermal comfort to the consumer, without compromising power of the slab. It is made further cost effective by using eggshell powder. The major ingredient of eggshell powder is lime as well as the key raw material used in the production of cement is limestone. Thus eggshell powder is traditionally utilized as partial substitute for cement, so the use of cement is decreased to some degree.

II. PRODUCTION OF EGGSHELL POWDER

The Associated Chambers of Commerce and Industry of India (Assocham) said that egg production in India is growing at afast rate. Calcium eggshell is a poultry waste with chemical makeup as that of limestone. Usage of waste to substitute in concrete rather than lime that is pure may have advantageslike using waste substance, preserving natural lime and reducing utilization of cement. Waste may be applied as animal feed ingredients, fertilizer and similar uses. Bulk of the waste is deposited as landfills.

S.No	Ingredients	Cement	Eggshell powder
1	SiO_2	21.8	0.08
2	Al_2O_3	6.6	0.03
3	Fe_2O_3	4.1	0.02
4	CaO	60.1	53.05
5	MgO	2.1	0.01
6	Na_2O_3	0.4	0.15
7	K_2O	0.4	-
8	SO_3	2.2	0.62
9	Others	-	0.62
10	LOI	2.3	45.42

Figure 1: Chemical Composition of Eggshell powder

Eggshell powder in concrete seems to be a good replacement of cement and at the same time it is more economic and easily available additive when compared all other additives that replaces the cement. The eggshell powder can be easily produced without any costly machineries. At first the eggshells are collected from local sources like hostels, hotels etc and then they are washed thoroughly to remove the impurities. It is then dried in sunlight for 5 days. The dried eggshells are then grinded well and finally it is sieved through 90 µ sieve. The eggshell powder thus obtained can be used for partially replacing cement.

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Figure 2: Egg shell grinded in powdered form

The specific gravity of eggshell powder is 2.3 and it is determined using pycnometer.

III. FILLER SLAB

Filler slab technologies is an advanced technology to get a slab structure and straightforward. In which it isn't much needed the secret behind filler slab structure is to improve the structure where, we could eliminate concrete. It's a economical roofing technique. It's not simple to remove the concrete in the pressure zone concrete could be substituted with very low cost filler substance and light weight. The filler substances are so put, to not undermine the structural power, durability and stability but leading in replacing undesirable and non-functional pressure concrete from under and consequently leading to market of high energy substance ingestion and respective cost savings and diminished dead load of the slab. An cavity can be supplied between the filler material which provides an edge.

Figure 3: Aesthetic appearance of filler roof slabs

IV. MATERIALS SELECTION FOR FILLER SLAB

Light weight, inert and affordable materials like low grade Mangalore tiles, Burnt Clay Bricks, Hollow Concrete cubes, Stabilized Mud cubes / Hollow Mud cubes, Clay pots, Coconut cubes etc. may be utilized as filler substances. These substances are put from the grids of metal reinforcement rods and concreting is performed . These points must be thought of as filler material choice:

Filler material ought to be inert in character. It shouldn't Respond with steel or concrete in RCC slab. Its water absorption ought to be assessed. Filler material ought to be light in weight so that weight of the slab decreases and the dead load on the bases is decreased.

Filler material needs to be of a dimension and cross-segment Thickness wise may be accommodated within this slab's part.

Filler material texture must fit with the ceiling complete Requirements as to not supply an ceiling layout.

The mangalore clay tiles of size 100 mm x 200 mm x 50 mm are used as filler materials.

Figure 4: Mangalore clay tiles of size 100 mm x 200 mm x 50 mm

V. ADVANTAGES OF FILLER SLAB

1. Filler slab Technologies Could be Utilized to mass housing Jobs to Obtain saving in Large energy Intensive Substances
2. Filler slabs could be retained vulnerable (with appropriate workmanship) to create visually pleasing ceiling with an opinion of filler material from under and therefore the price of plastering and painting can also be averted.

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3. This technique is sustainable and environment friendly by incorporating green building features.

Mix proportion with partial replacement of cement by Egg shell powder

S. No	Concrete Mix Design	Mix Ratio	Amount of Cement Conserved(Kg/m^3)
1	Conventional concrete	1 : 1.74 : 2.66	0
2	Concrete with replacement of cement by 2.5%	1 : 1.79 : 2.72	9.85
3	Concrete with replacement of cement by 5%	1 : 1.83 : 2.78	19.7
4	Concrete with replacement of cement by 7.5%	1 : 1.87 : 2.85	29.5
5	Concrete with replacement of cement by 10%	1 : 1.93 : 2.93	39.4

VI. COMPRESSIVE STRENGTH TEST ON CUBES

The compressive strength of a Substance Is the worth of compressive pressure when the substance fails reached completely. The strength is obtained by Way of a test that is compressive. Utilizing Compressive Testing Machine determines 150 mm. The cube specimen is tested for its compression in UTM and its average compressive strength is noted for 7 days and 28 days.

S.No	% OF EGG SHELL POWDER	AVERAGE COMPRESSIVE STRENGTH (N/mm²)	
		7 Days	28 Days
1	0	23.98	26.01
2	2.5	19.91	21.8
3	5	19.18	27.18
4	7.5	17.15	22.82
5	10	15.26	22.24

The compressive strength of cube is maximum at 5% replacement of eggshell powder to cement.

VII. CASTING OF SLABS

4.The slabs of size 2000mm x 500mm x 125mm were casted. The slabs like RCC slab (conventional), filler slab using mangalore clay tiles as filler material, filler slab using mangalore clay tiles with 5% partial replacement of cement using eggshell powder were casted and tested.

Figure 5: Preparation of mould, Arrangement of filler tiles and Casting of slab

Figure 6: Casted slab with its asthetic appearance

By employing gunny bags the slabs are treated. All slabs are Analyzed following a period of 28 days

VIII. RESULTS & DISCUSSIONS

Flexure strength test on slabs

Flexural strength, also known as modulus of rupture or fracture strength. Here the panel is laid horizontally over the supports. The casted slabs are tested using loading frame of 100 T capacities by applying two point loads. The slabs are tested for their ultimate load.

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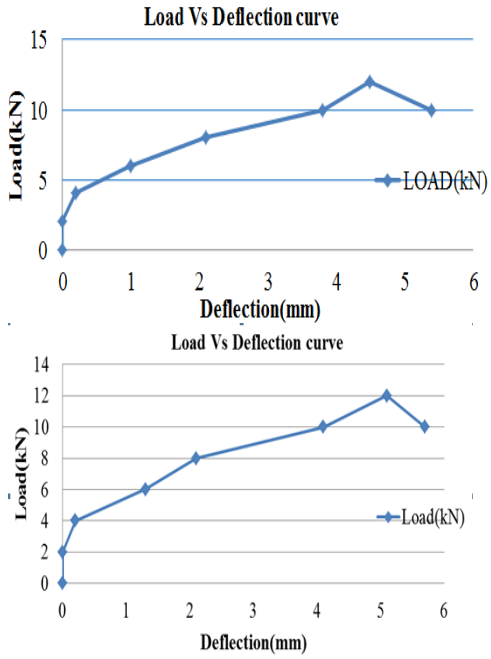
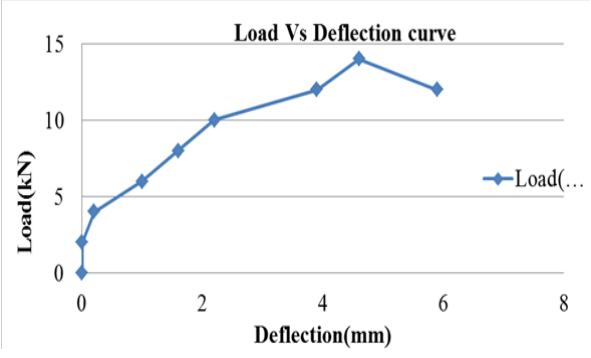
Figure 6.5 Testing of Slab Figure 6.6 Crack Pattern of Slab

Based on the deflection, corresponding appropriate load Vs deflection curve is plotted.



Load Vs Deflection Curve (Conventional Slab) Load Vs Deflection Curve (Filler Slab)

In conventional slab the initial crack occurs at 8 kN and its ultimate load is 12 kN. In filler slab the initial crack occurs at 8 kN and its ultimate load is 12 kN. This is similar to the conventional slab.



Load Vs Deflection Curve (Filler slab with Eggshell Powder)

In filler slab with 5 percent replacement of cement by eggshell powder, then the first crack happens at 10 kN and the greatest load capability of slab is 14 kN.

It is apparent that, the load capability of filler slab and ordinary slab is equal. Along with the load ability of filler slab is more decent together with substituting cement by 5 percent of powder and so cement is conserved to some degree, and increasing.

IX. CONCLUSION

From this project the following results were obtained

1. The accession of powder in seven days of healing compared to conventional concrete decreased compressive and flexural strength no matter proportions.
2. compared to concrete there is a version in flexural and compressive strength of concrete using powder.
3. Since the specimens with replacement reveals strength than concrete in addition to all other proportion of replacement the percentage for replacement of cement with powder is 5 percent.
4. The outcomes from loading framework proves that filler slab and the typical RCC slab possess similar load.

- The filler slab having 5 percent replacement of cement with eggshell powder has greater load carrying capability compared to both the standard and mucous slab.
- Thus Filler slab using powder appears to be economical and more much more efficient compared to the Filler and slab slab.

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