Experimental Investigation on Foam Concrete AluminiumMetalic Powder

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Abstract–**Ferro-cement is a reinforced mortar applied over a layer of metal mesh. Ferro-cement can be used widely in the construction of hulls of boats, roof shell, and water tanks. Hence ferrocement has a wide range of applications and it can be also used in the construction of roof slabs, lintels, and so on. The project aims about replacing certain constituents of ferrocement mortar. The replacement includes the addition of green admixtures. Aluminium powder is added to the cement in certain percentage. The steel mesh is used as reinforcement in ferrocement. The specimens are casted, and the experimental results are compared and investigated with the normal conventional**

cement mortar mix.

Keywords: Aluminiumpowder, steel mesh ferrocement

I. INTRODUCTION

Ferrocement construction technology is popular over the world.Ferrocement or ferro-cement is a system of reinforced mortar or plaster consisting lime or cement, sand and water applied over layer of metal mesh, woven expanded-metal or metal- fibres and closely spaced thin steel rods such as rebar. The metal commonly used is iron or some type of steel. It is used to construct hard, strong surfaces and structures in many shapes such as hulls for boats, roof shell, and watertanks.

.The reinforcing mechanism in ferrocement not only improves many of the engineering properties of the brittle mortar, such as fracture, tensile and flexural strength, ductility, and impact resistance, but also provides advantages in terms of fabrication of products and components. The present authors recommend that the experimental investigation may be conducted on new reinforcing materials by researchers in the future. The study concludes that the ferrocement will certainly be one of the best structural alternatives for RCC in thefuture.

Ferro-cement is a thin construction element with thickness of 10-25 mm and uses rich cement mortar; no coarse aggregateis used; and the reinforcement consists of one or more layers of continuous small diameter steel wire(Ordinary Portland Cement). In mixes B, C and D, the cement is added with 0.5%, 1%, and 1.5 % of aluminium powder to the weight of cement. It requires no skilled labour for casting and employs only little or no formwork. In ferrocement, cement matrix does not crack since cracking forces are taken by wire mesh reinforcement immediately below the surface. The strength of ferrocement depends on the following two factors , quality of sand and cement mortar mix and quantity of reinforcing materials used. The advantage of ferrocement is that they can be fabricated into any desired shapes.

II. MATERIALS AND METHOD

2.1 Materials:

Aluminium powder is used for the manufacture of foam concrete.The specific gravity of cement is determined as 3.15. The fineness if cement is determined as 8%.The specific gravity of the fine aggregate(Manufactured sand) is determined as 2.64.The fineness modulus of fine aggregate was determined as 3.58.Tap water is used for the mixing of raw materials. Conplast SP430 is used for workability.Steel mesh is used for the reinforcement of the slabs .

2.2 ConcreteMixes:

Concrete Mixes Four concrete mixes were prepared.The control mix (CM) A consisted of 100% OPC content was kept constant for all mixes.

Table 1 - Mix Proportions of Mixes

Materials (kg/m3)	A:0% Alumin- ium Powder	B:0.5% Alumin- ium Powder	C:1% Alumin- ium Powder	D:1.5% Alumin- ium Powder
Cement	18.7 kg	18.7 kg	18.7 kg	18.7 kg
Alumin- ium powder	0 g	93.5 g	187 g	280.5 g
Fine aggregate	46.7 kg	46.7 kg	46.7 kg	46.7 kg
Water	9.4 *l*	9.4 *l*	9.4 *l*	9.4 *l*

2.3 Casting andCuring:

For each mix, nine 70mmx70mmx70mm cube, 250 mm x 50 mm x 30 mm slab and 100 mm diameter 200 mm long cylindrical test specimens were cast. After 24 hours, the specimens were de-moulded and cured in water at room temperature until they weretested.

2.4 Testing:
Compressive Strength
The compressive strengths of three test 70mm x 70 mm x 70mm cubes were determined in accordance with BS EN 12390-3:2009: Testing hardened concrete: Compressive strength of test specimens. The specimens were tested for 7, 14 and 28 days ofcuring**.**

Split Tensile Strength Test
The tensile splitting strength of the two 100 mm diameter, 200mm long cylinders was determined according to BS EN 12390-6:2009: Testing hardened concrete: Tensile splitting strength of test specimens after 7 and 28 days of curing.

Bending Strength
The bending strength of two 250mm x 500mm x 30 mm concrete slab was determined according to BS EN 12390-5:2009: Testing hardened concrete: Bending strength of test specimens after 7 and 28 days of curing. A load was applied on the specimens with an increasing rate until failure of the specimen occurred.

2.5 Results and discussion:
Compressive strength
It can be observed that there is a general increase in the compressive strength of all test specimens from Day 7 to Day 28. It is observed that the compressive strength gradually reduces when the percentage of addition of aluminium powder in the mix is increased with respect to the cement content.

Split Tensile Strength Test
The tensile splitting strength variation for all mixes is shown in Figure 2. Cylinder of 100mm diameter and200 mm long is used for the testing. The aluminium content in the mix alters the tensile strength accordingly In Table the X axis denotes the curing period and Y – axis denotes the strength in$N//mm^2$KN and for 28 days it was 12.4,11.6,9.8The aim of this paper was to determine the effect of addition of Aluminium powder to the cement mortarThe compressive strength is highatC:Sratio1:2.5 and % of Alpowder 0.5% at28days curing.

Flexural Strength
Figure 3 shows the flexural strength results for each mix. The slab of dimension 250 mm x 500 mm x 30 mm is used for the flexural testing in the Universal testing machine.X- axis denotes the curing period and Y – axis denotes the strength in KN.

The split tensile strength is high at C:S ratio 1:2.5 and % Al powder 0.5% at 28 dayscuringwe conclude that the perfect mix ratio for foam concrete is C:S ratio 1:2.5 and the % of aluminium powder to be added is 0.5% by weight ofcement.

III. RESULTS

The compressive strength of concrete (0%, 0.5%, 1%, 1.5 % of addition of aluminium powder) at 7 days it reached the value 23.4,8.692,6.34 and 4.67$N/mm^2$and for 28 daysit was 27.08, 11.36, 7.35, and 5.34 N/mm^2The Split tensile strength of concrete (0%, 0.5%, 1%, 1.5 % of addition of aluminium powder) at 7 days it reached the value 3.02, 1.83, 1.51 and1.27 $N/mm^2$and for 28 daysitwas 3.58,2.14,1.82 and 1.51N/mm^2The Bending strength of concrete (0%, 0.5%, 1%, 1.5 % of addition of aluminium powder) at7daysitreachedthevalue9.2,8.4,7.6

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