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Utility of Ferro-Cement for Animal House Water Trough

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ABSTRACT

In ferro-cement, wire-meshes are filled with cement mortar. It is a composite, formed with closely knit wire mesh tightly wound round skeletal steel. Study was conducted with respect to application of ferro-cement for water trough construction which could be utilized for drinking water purpose for cattle's and other domestic animals. Mixed design of cement and sand ratios 1:1, and casting of ferro-cement water trough was hand plastering. Water trough capacity was 170 litres which will be suitable for cattle, bullock and other domestic animals. Water requirement of animals was recorded as: cow (40-45 litres), bullock (45-55 litres), buffalo (45-50 litres). So, water trough is suitable for herd of 4 cows /buffalos/bulls. The cost required per ferro-cement water troughs was estimated as Rs.1230/-

Keywords: Ferro-cement, Water trough, Animal house

INTRODUCTION

Ferro-cement is the composite of iron and cement mortar. Ferro-cement can be considered as a type of thin walled reinforced concrete construction in which small-diameter wire meshes are used uniformly throughout the cross section instead of discretely placed reinforcing bars and in which portland cement mortar is used instead of concrete. In ferro-cement, wire-meshes are filled in with cement mortar. It is a composite, formed with closely knit wire mesh tightly wound round skeletal steel.

MATERIALS AND METHODS

The details of the material required for construction of ferro-cement water trough are i) Ordinary portland cement (43 Grade), ii) Fine Aggregates, iii) Chicken meshes with hexagonal opening, iv) Water, v) Steel as per design, vi) Binding wire and vii) admixtures.

Ordinary Portland Cement (I.S.I. 269-1976): Some of the properties of the cement are; Specific Gravity(3.15), Standard consistency (34%) , Initial setting time (40min), Compressive strength (52.16 N/Mm^2). There are several types of cements available commercially of which normal or ordinary portland cement is the most common. This type of cement is adequate for applications where special conditions do not prevail. In this study normal portland cement (ASTM Type-I) was used.

Fine aggregates: Fine aggregates used were the aggregates passed through 4.75 mm IS sieve with a specific gravity 2.62. Well graded coarse sand commonly used for making concrete is good enough to prepare mortar for ferro-cement work (Anonymous, 1976). There should not be excess fine particles, and sand particles porous in nature since it affects durability and structural performance of the mortar. River borne well graded coarse sand having fineness modulus 2.3, was used for making mortar.

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Chicken Mesh: Galvanized chicken wire mesh with a hexagonal opening of size 12mm and a wire thickness of 1.29mm is generally used. About 2.54mm hexagonal poultry netting is often used in stables to trap poultry, rabbits and other small animals. Chicken wire is available in various wire gauges usually 19 gauge (about 1 mm wire) to 22 gauge (about 0.7 mm wire). In the insulation industry, chicken wire is mainly used as a matrix for holding insulation cements and mastics in place.

Welded chicken mesh- Welded mesh size (in inches): 1 x 1 , 2 x 1 , 2 x 2, 3 x 3, 4 x 4, 3 x 2 and height(in feet): 3 and 8. Wire Size; 1.4 mm to 6 mm manufactures and exports welded mesh and reinforced fabrics in 2 meter width and 6mm wire diameter. In square, rectangular dimensions from 13 mm to 200 mm openings. Specialized in M.S., G.I, stainless steel grade and straightened wire rods from 1.3 mm to 6 mm in any metals and accurate lengths. Stainless steel is widely popular due to its strength, hygienic and rustproof qualities.

Water: Potable drinking water was used for mixing and as well as for curing other constituent. The quality of water for mixing of mortar has a vital importance on the resulting hardened ferro-cement. Impurities in water like clay, acids, soluble salts or other organic matters may interfere with the setting time of cement and finally the strength of the structure. Sea water is not at all suitable. For mixing the mortar as it increases the risk of corrosion of the mesh and reinforcement. Supplied tap water was used for making cement mortar in present study.

The ferro-cement casting is done in four stages given as below,

i) Fabrication of reinforcement cage

ii) Preparation of mortar

iii) Plastering and

iv) Curing

Fabrication of reinforcement cage:

Generally M.S. steel is used for the cage. The spacing between vertical and horizontal steel is kept as 7.5 cm and 30 cm. The overlap of steel is 15 to 30 cm for binding of steel GI binding wire is used. Galvanized chicken mesh is to be bind to cage with the help of GI binding wire. As per requirement chicken mesh to be blinded in two to eight layers. The chicken mesh to be binded tightly on cage. The overlap of one layer to other is minimum 2 feet.

Preparation of mortar:

The proportion of cement and sand is 1:2 or 1:3. The water cement ratio is 0.4. Admixtures to be added if required. First dry mixing of cement and sand is to be done and water to be added as per requirement in mix.

Plastering:

Plastering is very important before plastering M.S. steel and chicken mesh cage is to be checked to be properly tied. The best method is to do by hand plastering. In the second method the plastering from inner and outer side is to be done. In the first method the internal and external portion to be done simultaneously. In the second method the plastering of internal portion to be done first and the plastering of outer side to be done secondly. After plastering within two to three days finishing being done. The plastering layer of 2 mm to be done over the steel reinforcement.

Curing:

Curing is very important for ferro-cement work. The curing for the completed ferro-cement work to be done after 24 hours. The curing to completed work to be done for minimum 14days and maximum up to 21 days. If the continuous water for curing is not available use jute bag and keep the jute bag wet so that the work water

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in the management of curing.

RESULTS AND DISCUSSIN

The design details of the water trough are given as below,

Length =100cm

Height = 52cm

Width = 65cm

Wall thickness=6.5cm

Internal dimension

Depth = 42cm

Length = 88cm

Width = 52cm

bottom width = 10cm

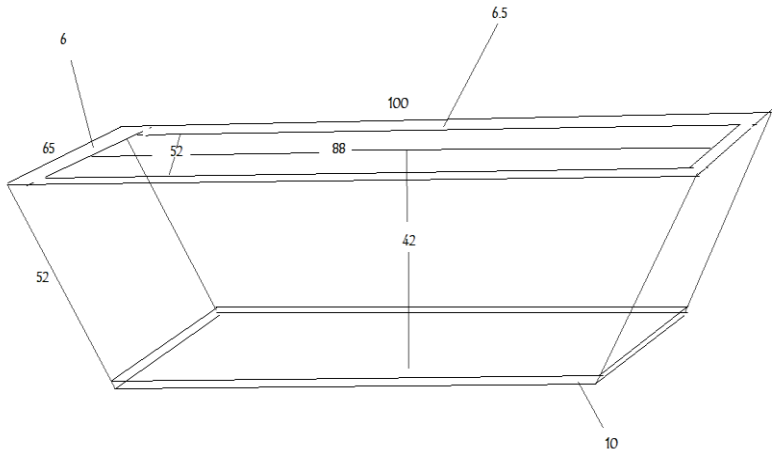

Fig. 1: Section of water trough

Design calculations:

1. Length of 4mm bent bar = 52+40+52

= 144 cm

No of bars =6

=144*6=864 cm

=8.64 m

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2. Horizontal bar = 100+52+52

= 204 cm,

No of bars = 4

=204*4=816=8.16 m

Bend bar + horizontal bar = 864+816=1680cm

=16.8 m

3. Hexagonal chicken mesh=

Vertical= [(0.65+0.40)/2]*0.52*2=0.546m^2

Horizontal= (1*0.52*2)= 1.04m^2

Bottom= 0.40*1*1 = 0.4m^2

Total= 0.546+1.04+0.4=1.986 m^2

4. Binding wire = 100gm

5. Cement = 30 kg

6. **Capacity of water trough** = **V**=

={[(0.52+0.4) / 2]*0.42}*0.88

=0.17 m^3 = 170 litres

Table 1: Properties of cement

Sr. No.	Test	Value
1	Type	Ordinary Portland cement
2	Specific gravity	3.05
3	consistency	32%
4	Initial setting	40 min
5	Compressive strength	51.40 mpa

Table 2: Cost estimation of water trough

Sr. No.	Materials	Quantity	Unit	Rate (Rs.)	Amount (Rs.)
1	Bar 4mm	20	m	15	300/-
2	Chicken mesh	2	Sq. m	100	200/-
3	Binding wire	100	gm	50	50/-
4	Cement	30	kg	340	200/-
5	Sand	30	kg	300	180/-
6	labour	1	Labour (lump sum)	300	300/-
Total(Rs.)					**1230/-**

Table 1 shows the various properties of the cement. It is seen from Table 2 that the cost required per ferro-cement water troughs was estimated as Rs.1230/-

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CONCLUSIONS

Water trough capacity is about 170 litres is suitable for herd of 4 cows/ bullock/ buffalos. The cost estimation of ferro-cement water trough was estimated as Rs.1230/- per unit.

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