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"A Case Study on Water Tank Construction by Ferrocement technology"

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ABSTRACT
The worldwide importance of the water and its conservation is on the prime importance now as days. The low-cost conservation and storage system for the house hold purpose attracts the attention of the new engineering. The low-cost binders and materials make it possible to blend it as the ferrocement technology. The use of ferrocement in construction is widely used worldwide. A thin material called ferrocement is employed in building construction and maintenance work. Thisacademic project work aims to conduct literature research on ferrocement and highlights key design elements, material characteristics, and unique methods of applying cement mortar to the reinforcing mesh for said storage tank. According to the study's findings, ferrocement will undoubtedly rank among the best structural substitutes for RCC in the future and can be used to build cost-effective water storage tanks.
Key Words: *Ferrocement, Construction, Repair material*

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I. INTRODUCTION

The use of ferrocement in construction is widely used worldwide. Ferrocement is a type of thin reinforced concrete construction in which behavior cement mortar is used in place of concrete and huge quantities of small-diameter wire meshes are employed uniformly across the cross section in place of discretely placed reinforcing bars. The most popular type of reinforcement is metallic mesh. As reinforcement, alkali-resistant glass fiber meshes and woven fabric made of plant fibers including jute, burlap, and bamboo have both been tested. The main topic of this essay is steel wire mesh. Ferrocement is a thin construction material with a thickness of 10 to 50 mm that employs rich cement mortar as opposed to coarse aggregate. One or more layers of continuous, small-diameter steel wire or netting serve as reinforcement. Standard masonry is typically not capable of being formed into any desired shape or structural structure, but ferrocement can. The ability to produce ferrocement through non-formwork building methods has an advantage over other forms of strengthening and repair methods.

II. METHODOLOGY

As per the IS codes for cement, steel and aggregates (IS 2386 part I, IS 8112, IS 383, IS 456) we conducted at laboratory test before using it for the building of the ferrocement water tank.
The adopted parameters and details of the design is as follows-

Estimate and design of tank

1. We consider a rectangular tank.
   - Calculation of capacity of tank

Dimension

- Outer Dimension of Rectangular Tank
  - Height = 1000 mm
  - Length = 740 mm
  - Width = 320 mm
- Thickness of wall = 35mm
- Volume of tank = 0.167 (with free board)

- Inner Dimension
  - Height = 1000 mm
  - Length = 670 mm
  - Width = 250 mm

2. Estimation of water tank
   - For 1 Tank

- Base wall volume

0.74 x 0.32 x 0.035 = 0.0083m^3

- First wall volume

0.74 x 1 x 0.035 x 2 = 0.0518m^3

- Second wall volume

0.25 x 0.032 x 1 x 2 = 0.0175m^3

- Total wall volume of mortar

0.0083 + 0.0518 + 0.0175 = 0.0776m^3

- Dry volume of mortar = 1.5 x wet mortar

=1.5 x 0.0776

=0.1165m^3

3. Materials quantity

- Cement Crushed Sand ratio 1:4
- Quantity of cement =$\frac{0.1164}{1+4}$ x 1 = 0.02328
- Density of cement = 1440 kg/m^3
- Cement = 1440 x 0.02328 = 33.52 kg
- Addition of 15 % losses = 1.15 x 33.52 = 38.54 kg = 39 kg (approx.)
- Quantity of crushed sand =$\frac{0.1164}{1+4}$x 4 = 0.09312
- Density of crushed sand = 1750 kg/m^3
- Required =0.09312 x 1750 = 162.96 = 163 kg
- Crushed sand = 0.09312 x 2.831= 0.2635 brass
- Addition of 15% losses = 1.15 x 0.2635 = 0.3030 brass
- Water = Quantity of cement / 3

  =34 / 3 = 11.33 = 12 liter
- Total weight of 1 tank = 34 + 163 + 12 =209 kg

4. For one tank total cost

- Steel mesh = 2.2 X 47.5 = 106 Rs
- Cement = 39 X 7.5 = 293 Rs
- Cost of sand = 0.30 X 3000 = 900 Rs

- Total cost of tank = 106 + 293 + 900 = 1299 Rs

CONSTRUCTION PROCEDURE

1. Required material

- Cement
- Crush sand
- Steel
- Wire mesh / chicken mesh
- Water
- Admixture

2. Site visit

- On the first day, we went to the location at APCOER Campus where the tank for rainwater storage will actually be installed.

3. Layout

- The actual shape of the tank that is being constructed is included in the tank's blueprint.

4. Collection of materials

- For the construction of the water storage tank, the materials that were readily available locally were gathered. Materials such as cement, crush sand, steel, chicken mesh, and additives were gathered close to the site where the ferrocement tank was being built.

5. Fixing of wire mesh to the Grid bar frame

- Mesh made of chickens First, we set the chicken mesh on the ground, then we placed the wire mesh on top of it, and then we wove the two together with binding wire.

Fig.Showing details of Grid of bars & chicken mesh

6. Applying of mortar

- After the framing of wire chicken mesh is done then the tank is ready to apply the mortar on it. The mortar is applied in such a way that the framed structure should not be visible after application. The care should be taken that the application of mortar is done properly at the bottom and inlet-outlet point of tank because there are more chances of seepage.

Fig. Showing details of applying mortor

7. Finishing and Curing

- Plastering will be completed after the tank is finished. The typical method of gunny bag curing system is used to cure the product for 28 days.

8. Complete and Ready for storage

Fig. Showing details of completed tank

III. RESULT

Following the completion of our Ferrocement tank's construction, we discovered that it is far more cost-effective than a traditional RCC tank.

The ferrocement water storage tank is evaluated for its numerous features, water losses, and water holding capacity after construction. Results of the examination were seen afterward.

- Due to proper curing and additive application during tank construction, there are no shrinkage cracks present.
- The water tank made of ferrocement has no cracks.
- When compared to conventional masonry and plastic tanks of same capacity, the construction cost and material requirements for ferrocement tanks are significantly lower.

IV. COCLUSION

Since the construction of this water tank was less expensive than the construction of an RCC water tank, we were able to build it using government funds. The ferrocement construction weighs roughly one-tenth as little as the standard material while being sturdy and long-lasting. The water storage tank was built utilizing the ferro-cement technique as the basis for the report. Such tanks were helpful for rural places with little water storage capacity and severe water shortages. The construction of the water storage tank can be determined to be successful using the ferrocement approach. By adopting the ferrocement technology, the locally accessible resources can be utilized for the cost-effective building.

The simple methodology of construction and adoption of this tank will help to conserve the water in rural area at affordable cost and durable source of the storage.

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