EXPERIMENTAL BEHAVIOUR ON FERROCEMENT CIRCULAR WATER TANK BY USING CHAIN MESH

S. Sekar[1], A. Abdul Basha[2], A. Ebinesar[3], T. Karthi[4], G. Nandha Kumar[5]
[1]Assistant Professor, [2,3,4,5]UG Students
Department of Civil Engineering, Muthayammal Engineering College (Autonomous) Rasipuram, Tamil Nadu, India

Abstract

Engineering is process of utilization of technology for the society. Civil engineering is field which is used to built roads, bridges, dams, canals, building, industrial structures, etc and also used for maintenance. However Civil Engineering plays vital role in developing infrastructure. In this project it is used for "Application of ferrocement technique to the rural area development for water storage structures".

The cost of construction is going up day by day due to enlarge cost of basic building materials such as cement, sand, steel, brick, timber and labor cost. The cost of construction using conventional building materials and construction techniques are not economical particularly for low income groups of population as well as middle income groups. Therefore there is a require to spread a cost effective construction technique or by up-gradation conventional technique or by applying new technology. This ferrocement tank construction is very easy to cast, cure and maintenance then manually erect on site. The strength and rigidity are developed through this system and it is cost effective. Hence it is ideally suited for prefabricated construction particularly for the people living in rural areas. The construction of the water storage tank includes different steps that are removal of flora from the design area, site leveling, materials selection which included water, cement, fine aggregate (M-Sand) and coarse aggregate for bottom PCC. The materials are mixed in the ratio of cement sand is 1:3 and water cement ratio is 0.40. The recommended tank dimension are Diameter x Height x thickness of 1.0m x 1.2m x 0.03m respectively for scheme incorporated. Tank is backfilled with nearby soil. Its property of improved homogeneity compared to R.C.C. and reduced thickness made it possible to employ the material as substitute to timber, steel and asbestos cement as material. Ferro cement is supposed to be a product of low level technology. As is true for all such technology, good and bad products can be made from the same set of materials, the difference being in the understanding and skill of the operatives.

Keywords: Ferrocement, Storage Tank, Chain mesh, Open mould system, cracking resistance, Low Cost technology.

I. Introduction

Ferrocement is a composite material composed of a mortar reinforced with fine steel, chain mesh used to form thin sections. The construction process consists of forming the shape of the required structure with a mesh of fine reinforcement, such as chicken mesh. Multiple layers may be used to achieve the required density of steel and the whole may be stiffened with a many standard reinforcing bars. A stiff mortar is then applied to both inside and out sides of the layer of reinforcement and finished to the required thickness for entire section. The technique is very labor intensive, as the mortar is generally hand-applied although can be spray applied. Thus it is mainly used in developing countries where labor costs are low. The main application for ferrocement water tank has been for the construct for storage of water for domestic purpose in all areas. It has also been used for roof shells and in decorative applications. Ferrocement is more widely used in Asia and parts of the Pacific. Here it is used for fishing boats of various sizes. In addition the

material is used for water tanks, storage structures and the like. In industrial nations, where there is little difference between the cost of skilled and unskilled labor, these advantages are less apparent and even disappear, explaining the relatively slow growth in the use of Ferrocement.

II. Methodology

- Collection of materials
- Testing of materials
- Fixing the reinforced wire and chain mesh
- Marking of Earthwork
- Mixing of raw materials
- PCC work for bottom of tank
- Side wall plastering
- Curing and storage of water

A. Cement Mortar

Cement Mortar is a workable paste by using of cement, sand and water in the ratio of 1:3 is used to bind with aggregates, fill and seal the irregular gaps in tank walls.

B. Cement Sand Ratio

The standard ratio of cement to dry sand 1:3 ratio by its volume. To achieve a standard ratio, the bucket can be used to accurately measure out proportions of sand and cement.

C. Water Cement Ratio

The water–cement ratio is the ratio of the weight of water to the weight of cement used in a mortar mix. A lower ratio leads to higher strength and durability, but may make the mix difficult to work with and form. The water cement ratio is used to the circular water tank is 0.40.

III. Materials Used

A. Fine aggregate

Fine aggregate (M-Sand) generally consist of crushed stone with most particles passing through a 3/8-inch sieve. Coarse aggregates are any particles greater than 0.19 inch, but generally range between 3/8 and 1.5 inches in diameter.

B. Cement

Cement is a pozzolanic binder, cement is used in the tank construction that good setting, hardening and bonding to other materials. Cement is seldom used on its own, but rather to bind sand and fine aggregate together. Cement is used with fine aggregate to produce mortar for masonry work in tank construction.

C. Water

The water used in the mix should to be dust and salt less, preferably of drinking-water quality. The PH is one of the quality mentioned parameter so the range of water used in the tank construction is 6.5 to 8.

D. Chicken mesh

Chicken mesh is a mesh of wire commonly used to fence in fowl, such as chickens, in a run or coop. It is made of thin, flexible, galvanized steel wire with hexagonal gaps. The main advantages of using the wire mesh are to avoid cracks in thin walled sections.

E. Chain mesh

Steel chain meshes are considered the primary mesh reinforcement. Chain mesh is also versatile and is the standard choice for property owners, developers, building contractors and government departments. The chain mesh is used to as a main reinforcement in the tank construction.

Fig 1. Chain mesh

IV. Construction of Circular water tank by Chain Mesh

Fig 2. Earth marking

Fig 3. Bar bending

Fig 4. Fabrication of steel

Fig 5. Skeleton set up

Fig 6. Erecting

Fig 7. Mortar mixing

Fig 8. Applying mortar for bottom

Fig 9. Side wall plastering

Fig 10. After completion of wall plastering

Fig 11. Outside wall finishing

Fig 12. Tank inside finishing

Fig 13. After completion of work

Fig 14. Curing

A.Economics

It can be observed that the reinforcement represents the major cost factor in Ferrocement, followed by the labor cost. Labor cost can be reduced through efficient planning and mechanized production processes. High cost of the chain mesh is mostly due to the cost of production of the mesh system itself and to the limited demand. With increasing market, chain mesh system can be produced more efficiently and at a lower cost. Therefore, resulting in a remarkable reduction of the Ferrocement cost.
Among the more significant qualities of the Ferrocement mentioned earlier

- Low consumption of materials.
- It can take any shape most of the times without using form working.
- When worked correctly, it is practically impermeable.
- Good behavior to cracking.
- Easy to be repaired.
- It can be prefabricated.

B. Advantages of tank

- Raw materials required for Ferrocement tank construction are easily available.
- The fabrication of the mesh can be done in many shapes that suit the requirements.
- Ferrocement tanks are more durable and are cheaper than steel and wood.
- Application of Ferro-cement tank doesn't require any heavy machinery.

V. Conclusions

The following features are concluded from the study of ferrocement circular shape chain mesh reinforced water tank.

- The stiffness if tank was good. This may be due to the presence of chicken mesh.
- The water tank showed good ductile behavior.
- Spalling of mortar was not observed even at loading conditions which proves the safety of using the tank.
- From this study it is concluded that chain mesh reinforced ferrocement water tanks can be effectively used as storage tanks for various purposes.

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