

FEASIBILITY OF USING PRE-STRESSED CONCRETE OVER CONVENTIONAL REINFORCED CONCRETE IN WATER RETAINING STRUCTURES

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Water is considered the source of living for every creation, as it is a crucial element for healthy living. A Safe and adequate supply of potable water is one of the basic elements for the human to sustain a healthy life. Concrete is generally the most common material of construction of water tanks and when correctly designed and constructed, will provide long life and low maintenance cost. It is important to carry out both the design and construction of water retaining structures properly, otherwise, it would not give the intended service. Water tanks must be designed so that liquid is not allowed to leak or percolate through the concrete structure during the life of the structure. With the rapid speed of urbanization, demand for drinking water has increased by many folds. Also, as demand for water tanks will continue to increase in the coming years, quick construction methods and the most economical method will be helpful in the selection of tanks for real design. PC is the best solution for that. In this paper, design guidance for PC circular water tanks resting on the ground is presented. Both reinforced concrete (RC) and prestressed concrete (PC) alternatives are compared considering the total cost of the tank.

The design and construction approaches for PC circular water tanks were identified following BS 8110-1: 1985 and BS 8007: 1987. The finite element software model of each tank was developed separately and each of the circular water tanks was analysed using Midas Gen software. The FEM-based design procedure developed in this research could be used to complement and supplement the existing design methodology for PC water retaining structures. The output of reinforced concrete designs and the output of post-tensioned concrete designs were converted into structural drawings and bills of quantities. Finally, both outputs were compared. Results of the material take-offs showed that RC is economical only for 4000 m³ or less capacity. For higher capacities, a PC tank cost about 12-14% less than the corresponding RC tank at prices prevailing in 2020. The paper helps in understanding the design philosophy for the safe and economic design of water tanks with better crack control.

Keywords: circular water tank; prestressed concrete; reinforced concrete; minimum total cost; tank capacity

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