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ANALYSIS OF ELEVATED WATER RETAINING STRUCTURES USING FINITE ELEMENT METHOD

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DECLARATION

I, S.K.L.S. Rupasinghe, hereby declare that the content of this thesis is the output of the original research work carried out at the Department of Civil Engineering, University of Moratuwa. Whenever others' work is included in this thesis, it is appropriately acknowledged as a reference.

ABSTRACT

In water supply schemes, concrete structures are used to store the required quantity of water for distribution for an area. In the case of design of these structures, a precise and accurate analysis is considered as a significant issue. Especially in elevated towers such as Intze Tanks, Conical Tanks and Cylindrical Tanks, the membrane shell theory is used extensively in analyzing those structures. The Intze tanks prove to be economical for storing medium and large capacities. It is useful to analyze these structures to obtain a cost effective solution. In most of the structures mentioned above have hoop tension as critical in many parts of the structures due to the water pressure on the sections. Therefore, reduction of hoop tension of the structure is important to reduce the requirement of reinforcement in the particular section.

In the research, the elevated structures were analyzed by using the membrane theory. Also the structures were modeled using the Sap 2000 software to compare the results of shell theory with computer modeling. The aim is to investigate the potential for optimization.

In this research, the Intze type structures were modeled and analyzed by using the finite element analyzing (FEA) software to check the difference of results between Shell theory and FEA at different locations. The model has shown that the membrane moment and forces obtained from the Finite Element Analysis was considerably lower than the results that have been obtained from manual calculations at certain locations. According to the FEA results, the membrane forces are low in the sections of cylindrical wall, conical bottom and supporting shaft.

In order to assess the benefits of more accurate analysis, the structure were redesigned by using the results obtain from FEA to calculate the benefit of cost in finite element analysis & design. A cost analysis was performed to quantify the cost advantages.

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