STRENGTHENING OF HYDROSTATICALLY LOADED CYLINDRICAL STEEL TANKS USING GFRP

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STATEMENT

This dissertation is submitted to Ain Shams University, Faculty of Engineering for the degree of M.Sc. in Civil Engineering.

The work included in this thesis was carried out by the author in the department of Structure Engineering, Faculty of Engineering, Ain Shams University, from January 2011 to November 2014.

No part of the thesis has been submitted for a degree or a qualification at any other University or Institution.

The candidate confirms that the work submitted is his own and that appropriate credit has been given where reference has been made to the work of others

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DEDICATION

I wish to dedicate this work to who suffered to educate, support and encourage me during the thesis work

To my parents,

My brothers & my wife

Also, I wish to dedicate my thesis to the late
Prof. Dr. Magda Alrakabawy
For her help at the start of the search.

Also, I wish to dedicate my thesis to my professors

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Dr. Mohamed saafan Abd-El Gawad

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ABSTRACT

This study investigates a new method of strengthening cylindrical tanks subjected to hydrostatic load. Small amount of glass fibre-reinforced polymer (GFRP) sheets, used at a critical location, can effectively increase their buckling strength. A 3-D finite element model was developed to study the behaviour of cylindrical tanks with and without GFRP subjected to hydrostatic load. The finite element model was developed using ANSYS program**.** The state of instability under the influence of geometric and material nonlinearity is studied. The developed 3-D finite element model was compared and verified with previously published data.

Twelve tanks with variable dimensions and thicknesses were studied. The radii (R) of tanks selected are 5m, and 10m. The height to radius ratio values selected are 1.5, 2, and 2.5, where H is the height of the tank. The results obtained from the finite element analysis for steel tanks without and with strengthening of GFRP height equal to 0.3H and different thicknesses are presented.

Comparison between the buckling strength of perfect cylindrical steel tanks with and without GFRP is presented. The results show the benefit of using GFRP as a strengthening method for such structures. The strengthening effect is shown to be sensitive to the thickness and the location of the GFRP sheets.

Although perfect tanks are considered in this investigation, which is not the real case as the buckling strength decreases by including the imperfections, yet this, is a comparative study to show the effect of strengthening cylindrical tanks with GFRP.

Keywords:

Strengthening, Buckling, Hydrostatic pressure, GFRP, Finite Eelement Analysis, Cylindrical Steel Tanks.

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