

THE RESPONSE OF EXISTING CONICAL WATER TOWERS IN SRI LANKA TO EARTHQUAKE

By

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THIS DISSERTATION WAS SUBMITTED TO THE DEPARTMENT
OF CIVIL ENGINEERING OF THE UNIVERSITY OF MORATUWA
IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE
DEGREE OF MASTER OF ENGINEERING IN STRUCTURAL
ENGINEERING DESIGNS

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May 2011

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DECLARATION

I, D.P.M. Chandana, hereby declare that the content of this thesis is the output of 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.



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ACKNOWLEDGEMENT

My foremost duty is to express my sincere gratitude to my supervisor, Prof. M.R.T. Jayasinghe, Professor in Civil Engineering at the Department of Civil Engineering, University of Moratuwa, for valuable guidance in making this dissertation a success.

My appreciation to the Dean of the Faculty of Engineering, lecturers from the Department of Civil Engineering who have taught me during my post graduate course.

My love to my father Mr. D.P.M. Sadiris, who always encourage me to do further studies. Love and affection to my mother Mrs. Hemalatha Weerarathna, my wife, my sons Ginura, Sasvidu and my family members including Lakshmi and Lenin for their patience and understanding.

Finally, I am grateful to my organization, the National Water Supply and Drainage Board for the sponsorship and encouragement given to me to complete this program.



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ABSTRACT

The shaft support of elevated conical tanks should have adequate strength to resist axial loads, and moment and shear forces due to lateral loads. These forces depend on the total weight of the structure which varies with the amount of contents present in the tank container.

In Sri Lanka, use of Conical type water towers for storing in almost has been a practice in the country for a considerable period. All the structures, designed have been carried out for high winds. However, hardly any designs were carried with sufficiently serious attention given for earthquakes, since the location of the Sri Lanka was not considered as an earthquake prone area.

Main objectives of the research are to investigate the structural adequacy of existing conical type water towers for earthquakes and development of relationship with seismic analysis for the tanks which have designed for wind loads.

In order to achieve the above objectives, three different conical type water towers were selected which has capacities of 200 m³, 300 m³ and 750 m³. These water towers were analyzed for 53.5 m/s, 47 m/s, 38 m/s wind speeds which have been prescribed for post disaster structures for different zones in Sri Lanka. For earthquakes, dynamic analysis carried out for the same tanks using SAP 2000 - v14 for different soil types. Base shear and moments calculated using spring mass model.

It has reveal that the existing structures which were designed for prescribed wind speeds were not adequate for resisting minor earthquakes. Also Impulsive mode of most of the water towers would have a natural period of vibration (T) are in the range of 0.3s to 0.8s which will give the highest response (base shear and moments) in an Earthquake.

Since the response corresponding to the Natural period of vibration (T) of the conical type water towers is very high, it is not practical to give general

recommendations or guidelines. Therefore, it is advised to carry out a dynamic analysis for the design of conical type water towers, so that necessary changes to the shaft diameter and thickness can be selected to resist the expected loads.

Base shear and moment induce for 200 m³ tank in 25 % and 50% tank full condition is less than the tank empty condition, when analyze using spring mass model. However other large capacity tanks do not gives that kind of relationship. Therefore Detail investigating about the impulsive and convective modes for containers having internal obstructions and behavior with percentage filling of water could be recommended for future work.



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