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# Non-Linear Time History Analysis of An Elevated Water Tank

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***Abstract-*** *In terms of seismic resilience, it was determined that reinforced concrete raised water tanks with frame staging outperformed reinforced concrete elevated water tanks with shaft staging. This might be owing to the frame staging's capacity to absorb seismic energy. As a consequence, the major purpose of this study is to learn more about the seismic behaviour and performance of raised water tanks with frame staging. Furthermore, circular tanks have the least surface area for a given tank size when compared to other forms. As a consequence, the material required for a circular water tank is less than that required for other forms. As a consequence, a circular water tank was selected, and seismic study of raised RC circular water tanks was performed according to IITK-GSDMA criteria, with the water tank's behaviour examined for various factors such as zone factor, soil condition, and different staging heights. The modal properties of the structure were determined using SAP 2000. (mode shapes and modal participation mass ratio).*

## I. INTRODUCTION

### 1.1 General

Elevated water tanks are commonly used in public water distribution system. Being an important part of lifeline system, and due to post earthquake functional needs, seismic safety of water tanks is of considerable importance. Elevated water tanks also called as elevated service reservoirs (ESRs) typically comprises of a container and a supporting tower (also called as staging). Staging in the form of reinforced concrete shaft and in the form of reinforced concrete column-brace frame are commonly deployed. The column-brace frame type of staging is essentially a 3D reinforced concrete frame which supports the container and resists the lateral loads induced due to earthquake or wind.

Aim of the present study is to bring out the differences in seismic behavior of column beam (Building) frame and column-brace (staging) frame in the post-elastic region and to quantify their ductility. In addition, nonlinear dynamic analysis is also performed to bring out the differences in the nonlinear dynamic behavior of twithout types of frames. Pushover analysis is an approximate analysis method in which the structure is subjected to monotonically increasing lateral forces with an invariant height-wise distribution until a target displacement is reached. Pushover analysis consists of a series of sequential elastic analysis, superimposed to approximate a force-displacement curve of the overall structure. A twithout or three dimensional model which includes bilinear or tri-linear load-deformation diagrams of all lateral force resisting elements is first created and gravity loads are applied initially.

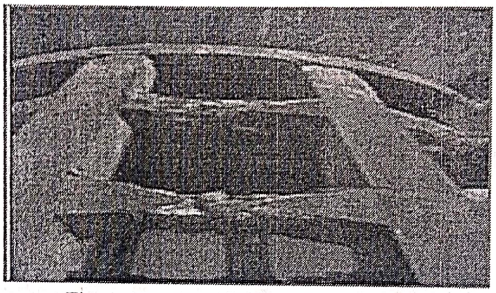

**Fig. 1 : Bending Shear Failure in beam**

So far, there has been no experimental test program (such as shaking table) that has studied the nonlinear response of RC pedestals to the strong ground motions.

### 1.2 Performance of elevated water tank

Geological and seismological discoveries during the 20$^{th}$century have helped in initiating the development of seismic building codes and earthquake resistant buildings and structures. The improvement in seismic design requirements has led to more robust, safe and reliable buildings. Due to the earthquake many buildings collapsed killing thousands of people. Therefore, to protect the earthquake effects/earthquake damages to the buildings and to protect the life of people, it's important to use seismic control techniques.

### 1.3 Various analysis systems