# Evaluation of Steel Type Effects on Axial Stress Distribution of Aboveground Tall Cylindrical Tanks under Earthquake

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ABSTRACT

*Axial stresses magnitude on the shell wall of steel tanks are one of the most important factors in health monitoring of these kinds of reservoir. Controlling of the maximum amount of these factors can guarantee the safety of the tanks performance. As the objective of this paper to study aboveground tall cylindrical tanks, the Finite Element Modeling (FEM) strategy was used to simulate dynamic response of these systems. Abaqus is used as the main finite element computer simulation software to make a nonlinear dynamic analysis. The simulated results visualize the distribution of axial stress of tanks shell under seismic loading.*

*It is shown that for unanchored tall tanks the axial stresses amount in the case of using steel ST52 is much less than using ST37 which can be so important for structural designing.*

**Keywords:** Cylindrical Steel tanks, FEM, buckling, Axial Stress, Explicit dynamic analysis.

## 1. INTRODUCTION

Aboveground cylindrical steel tanks are extremely vulnerable under seismic forces. Seismic safety of these containers is one of the greatest concern of civil engineers. The sloshing phenomenon in these structures should be considered carefully. As a result, a considerable amount of research efforts have been concentrated on this field to gain a better determination of the seismic behaviour of these structures. Housner [3], Veletsos and Yang [4], Malhotra [2] and many other researchers Most of the previous focused their investigations on proposing mechanical models for computing the seismic response of liquid storage tanks. Malhotra [3] investigated that such tanks have sustained damage in the form of at least four categories:

(1) The failure of the piping connections to the wall, caused by large base uplifting
(2) Rupture at the plate-shell junction, caused by excessive joint stresses
(3) Buckling of the tank wall, caused by large axial compressive stresses
(4) Failure of the soils underneath, caused by excessive foundation penetrations

The objective of this paper is to study the steel type effect of on the axial stresses developed in the wall of liquid storage aboveground cylindrical steel tanks under the earthquake. The Finite Element Modeling (FEM) strategy was used to simulate the dynamic response of liquid tank system.

## 2. Fluid-structure-soil interaction

It is the combination of fluid structure interaction and Soil structure interaction. Fluid structure interaction (FSI) is the interaction of some movable or deformable structure with an internal or surrounding fluid flow, which in our case is an elevated steel water tank. The deformations of a structure during earthquake shaking are affected by interactions between three linked systems: the structure, the foundation, and the geologic media underlying and surrounding the foundation. A
seismic Soil-Structure Interaction (SSI) analysis evaluates the collective response of these systems to a specified free-field ground motion.

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