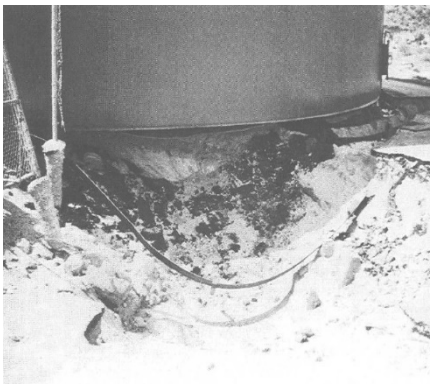
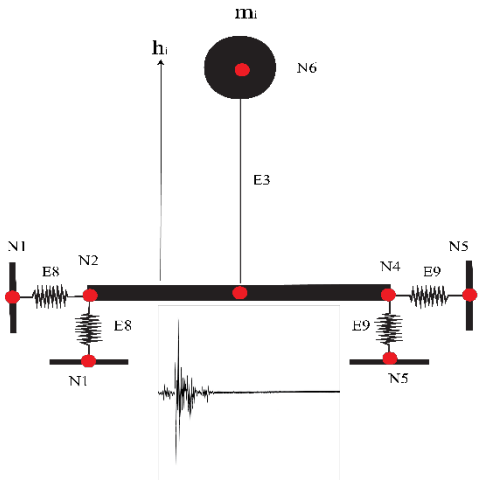
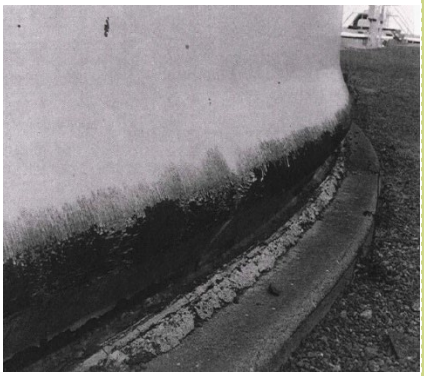
# Seismic Fragility Analysis of Above-ground Liquid Storage Tanks





**MS Defense**

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**Thursday, July 24, 2025, 10 am to 11:30am**

**Location: EB 202L - CEE Conference Room or virtually at https://pdx.zoom.us/j/82990599620**


## Abstract

Liquid storage tanks are critical infrastructure, serving as key storage facilities for various products. As the contents in these tanks are usually highly toxic and flammable, damage to these structures under earthquakes can cause severe consequences, including energy shortage, fire and explosion, and spilling and long-term environmental damages. Although new liquid storage tanks are designed according to the updated seismic design codes, large numbers of existing storage tanks were built before modern seismic design codes and did not undergo necessary seismic retrofitting. Under earthquakes, liquid storage tanks may experience several failure mechanisms due to the dynamic interaction between the fluid and the structure, most notably elephant foot buckling (EFB) and cracking or rupture at wall-base connections (connection failure). Focusing on EFB and connection failure, this study proposed a streamlined approach to assessing the seismic vulnerability of unanchored steel liquid storage tanks. Specifically, this study developed seismic fragility curves for liquid storage tanks, which quantify the tank failure probabilities at different earthquake intensity levels. The sensitivity of seismic fragility to tank geometries and filling levels was also investigated. It was found that the seismic fragility of unanchored tanks is especially sensitive to filling level, with a higher filling level causing a greater failure probability. These insights can support decision-making in seismic risk mitigation and contingency planning.


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