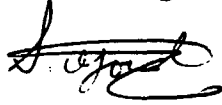


MEMO

January 5, 1998

TO: Ms. Anna H. Virbick, Acting Director, OUST

FROM: Sam Gordji¹ 

SUBJECT: Finite Element Analysis of UST

Attached is a three dimensional finite element simulation of a UST. The top mesh represents the unloaded structure and the bottom mesh which is distorted represents the loaded structure when a delivery truck stands directly above the UST and exerts pressure on the surface and therefore on the UST. If the surface is rigid such as concrete, the effect is minimal but if the surface is clay, sand etc. this pressure and the loading that it causes may have an adverse effect on the UST. Due to the tank symmeiry only one fourth of the cylinder has been analyzed to save expensive computer and programming time. In this study it is assumed that USTs are shell like structures and, therefore, the formulation of the problem is based on the **general theory of thin cylindrical shell.**

This preliminary study indicates that the loading of a UST structure causes the structure to yield and deform as is shown in the following model. This is specially true when the load has a short time period, the load is applied in less than a few second and then removed. Steel structures are elastic and will generally go back to their original form as soon as the load is removed. Fiberglass materials are not and under certain loading conditions may deform or crack. Lets not forget that constant deformation cased by loading and unloading a UST almost always accelerates the **natural corrosion process.**

The following parameters were used to arrive at this result. These parameters differ slightly for each manufacturer. Steels and fiberglass materials whose properties may yield different results from these. The result of this study is not alarming but it indicates that further study is need to make sure that regular and instantaneous loading and unloading of fiberglass or steel USTs beneath a soft surface does not compromise their integrity.

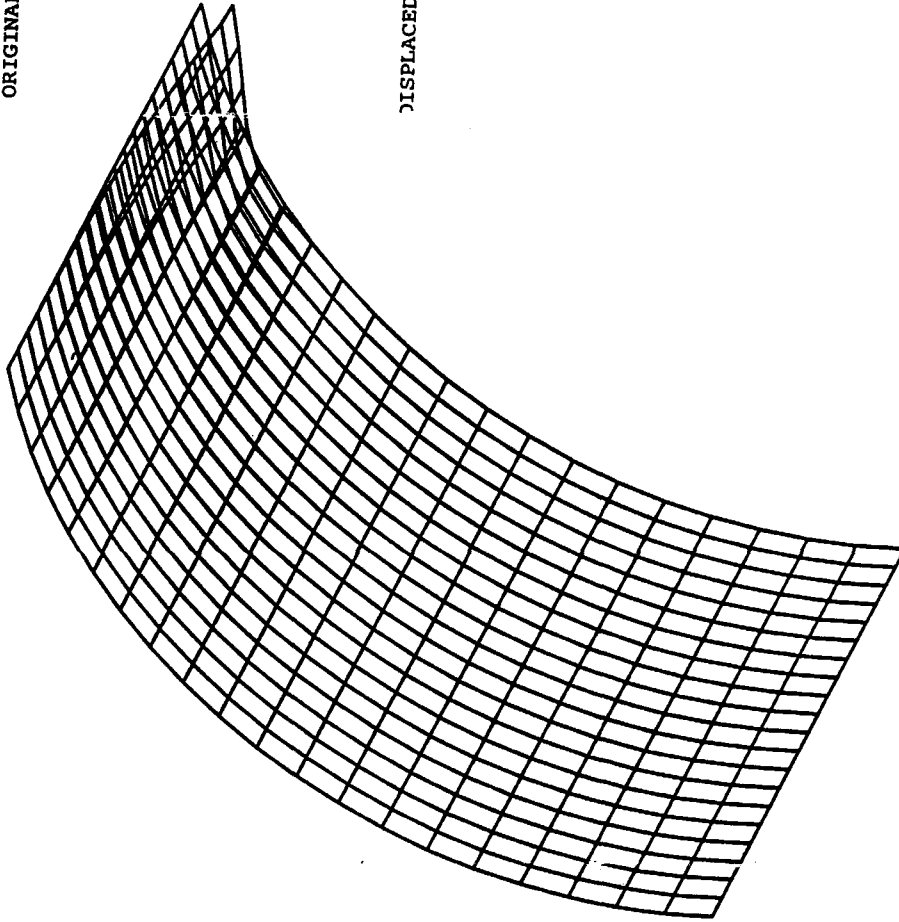
The deformation here is about 2.7% to 3% of the tank's radius. Exact material and soil properties are needed to calculate the correct deflection caused by 80,000 lb. load allowed by US Department of Transportation.

Parameters used for fiberglass: Young's Modulus of Elasticity = 10^{**6} , Possion ratio=.3, Density=.03

Cc: National Work Group on Leak Detection Evaluations
Ms. Mary Stainson
Tank Manufactures & Corrosion Specialists
L.U.S.T. Line
Third party testers

¹Dr. Sam Gordji, Suite 301, 202 Virginia St. Oxford, MS 38655
Ph. 601.234.1179, Fax 601.234.8427

ORIGINAL MESH



DISPLACED MESH, LOADED

