



# TAYLEX UNDERGROUND POLYETHYLENE SEPTIC TANK Non-Linear Geometric Analysis of Composite Construction

Date: July 2010

Client: Trymak Product Development

## Project Description:

David Beneke Consulting was commissioned by Trymak Product Development on behalf of Taylex Tanks to undertake a finite element analysis (FEA) of a 5,000 litre underground septic tank. This tank was significantly different to those of traditional roto-moulded construction in that the inner and outer walls of the tank are of composite foam core construction. The outer and inner layers of each wall section are composed of a thin layer of linear low density polyethylene (LLDPE). The material in between is a LLDPE foam core. The purpose of the FEA was to determine the minimum overall thickness of the cross section and the minimum thickness of the inner and outer skins which satisfied the requirements of AS/NZS1170.0, AS/NZS1546.1 and the draft underground tank standard.

The geometry for the tank was imported into Strand7 FEA software and meshed using QUAD4 plate/shell elements. Regions of the FEA mesh in which the inner and outer wall sections "kissed-off" were joined together using a series of rigid links. The material properties for the LLDPE material were essentially linear elastic with allowances made for both long and short term load combinations. However, the values adopted for the membrane and bending thickness of the plate/shell elements were modified so that a single thickness element could simulate the stiffness of the composite construction.

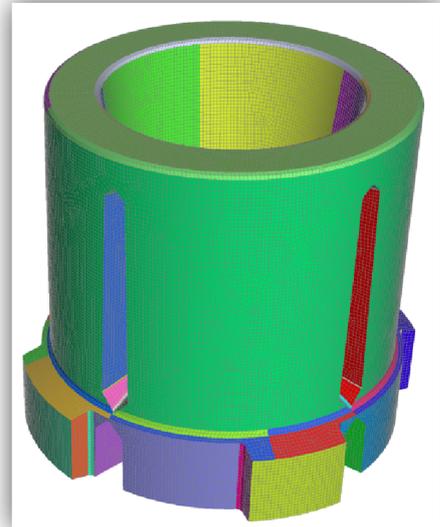
Based on a series of non-linear geometric analyses, the minimum wall thickness was derived which satisfied -

- \* Ultimate limit state stress limits
- \* Buckling instability at ultimate load &
- \* Serviceability deflections
- \* Simulated test loads to AS/NZS1546.1

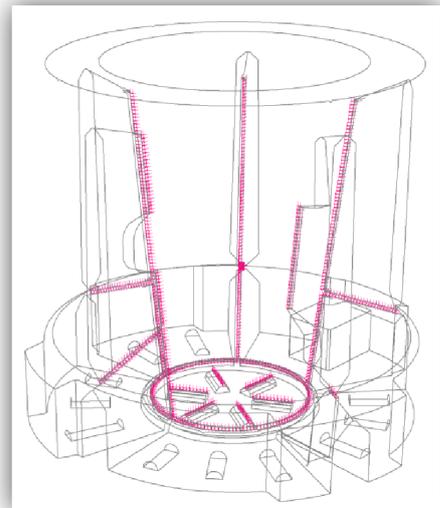
It is noted that the analysis work neglected potential de-lamination effects given that this would be verified via full scale test.

## Contact:

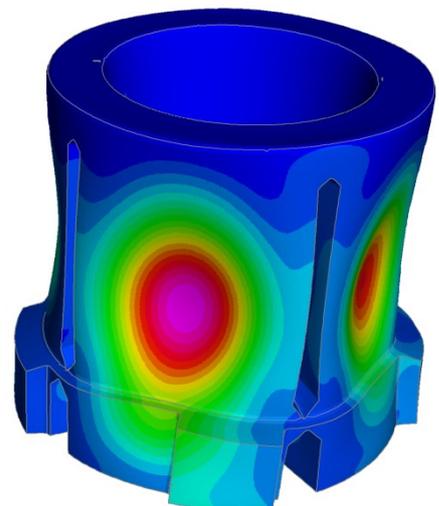
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FEA Model of the 5,000 litre underground septic tank



Outline wire frame of FEA Model indicating kiss-off zones with rigid link elements (red)



Contour plot of deflections under lateral load test.