

The Problem

Our client's facility consists of grit separators used in wastewater treatment to separate out suspended solids, such as sand and grit. A number of failures of the trays were discovered, including complete inversion of the first few top trays and significant sagging of the trays when the larger diameter units are placed in the sun during storage or transport. MMI was asked to provide a structural solution to prevent these trays from deforming.

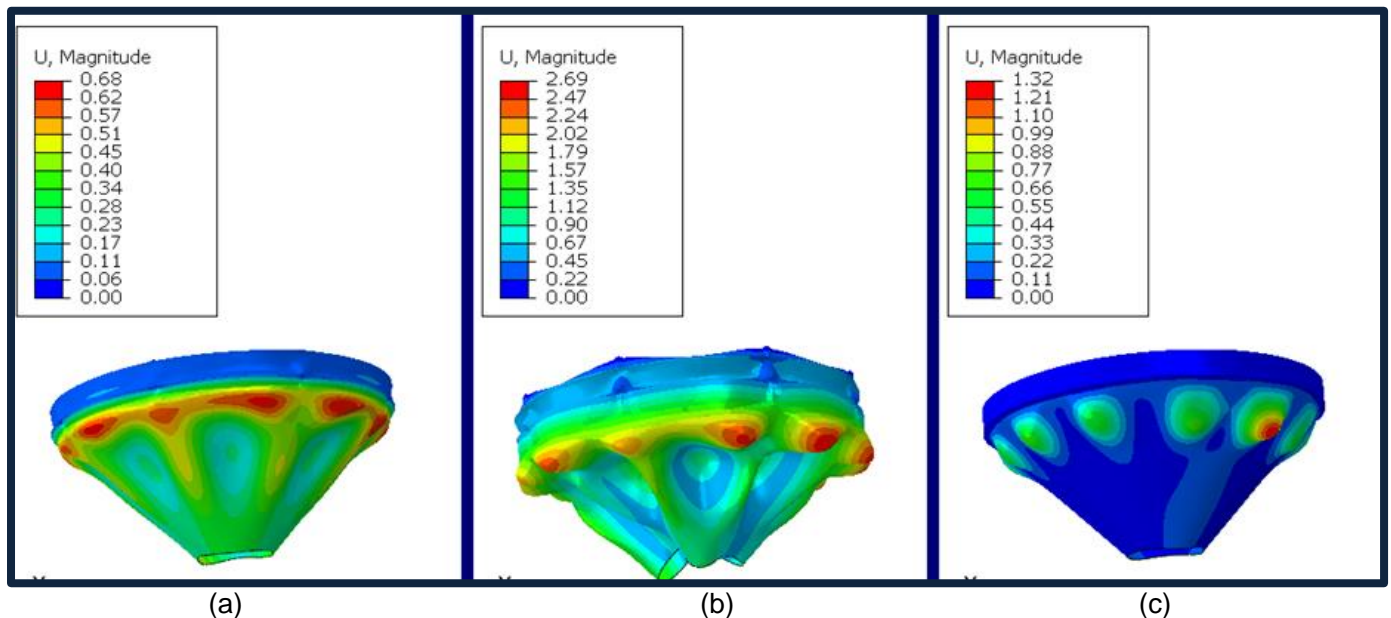
Our Approach

We assessed the buckling behaviour of the tray under applied loads using finite element (FE) analyses. The buckling assessment consisted of the following analyses undertaken sequentially:

1. Linear eigenvalue buckling analysis to predict the preferred mode of collapse; this was used to define an initial manufacturing imperfection in the tray.
2. Modified Riks analysis to simulate the post-buckling response of the tray with a given imperfection and determine the static buckling load.

Outcome

The analyses predicted collapse pressure loads lower than the design pressure using long term material properties of the polymer. Further analyses were undertaken to assess the effect of tray thickness and material properties on the buckling behaviour of trays. Recommendations were made for the minimum required thickness of the tray and alternative materials with better long-term tensile properties based on availability and manufacturers experience with particular blends.



FE predicted deformed shapes under distributed pressure using (a) 10%, (b) 50% and (c) 75% scale factors