

WEST COATS POLY 17,000 LITRE CARTAGE TANK

Non-Linear Analysis – Geometric and Boundary Contact

Date: February 2023

Client: West Coast Poly

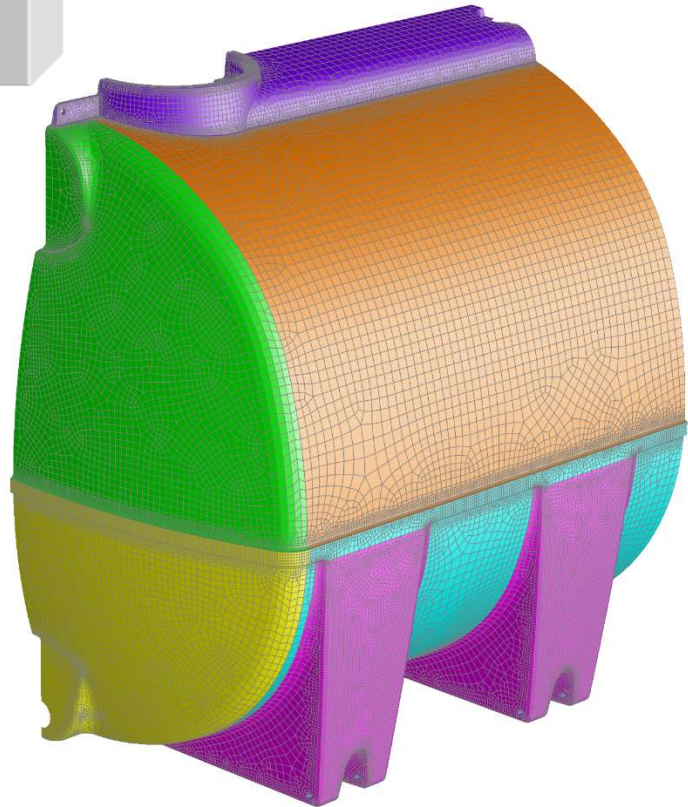
Project Description:

David Beneke Consulting was commissioned by West Coast Poly to undertake a finite element analysis (FEA) of a 17,000 litre cartage tank rotationally moulded from linear low density polyethylene (LLDPE). This tank was mounted on a structural steel frame which was then in turn mounted on either a truck with articulated trailer or on a non-articulated truck.

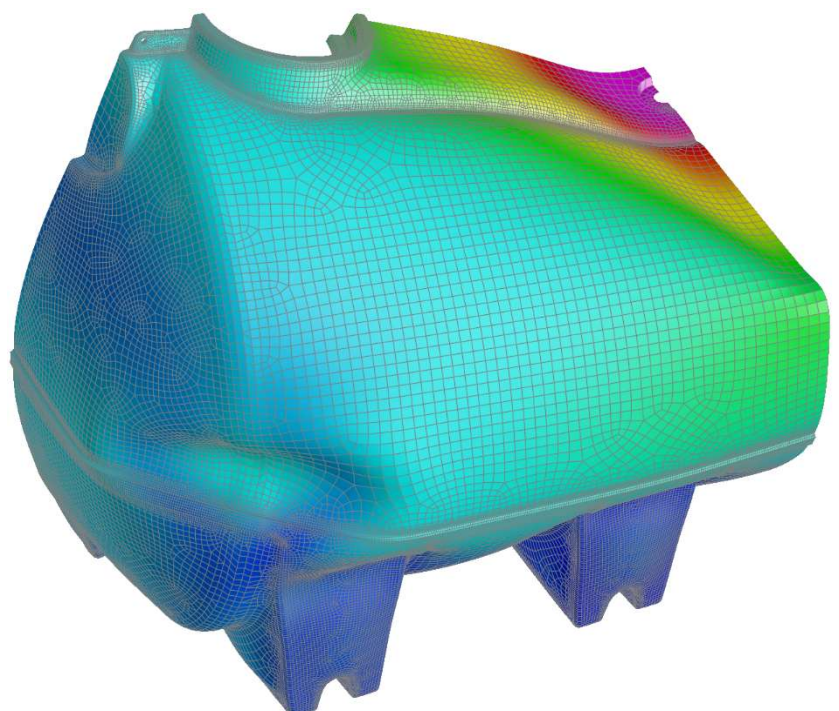
The critical thing about the design of this tank was that it was exposed to not only liquid pressure loads from the stored liquid (both water and liquid fertilizer of $S_g=1.5$) but it was also exposed to road transport loads of up to 0.8g for longitudinal deceleration and 0.5g transverse acceleration as well as wind loads when the vehicle was travelling at a maximum of 130km/hr.

The analysis of the tank used the non-linear static solver of Strand7 R3.3.2 incorporating geometric and boundary contact non-linearity. The boundary contact was restricted to the contact surface along the base of the tank as well as that around the locking pins at each leg.

An interesting result of the analysis was that for very low material thicknesses, the tank exhibited multiple buckling modes acting at the same time including snap-through buckling of the roof accompanied by tin-can buckling in the walls.



FEA Model of the 17,000 litre cartage tank - outside view



Combined snap-through roof buckling combined with "tin-can" buckling of the walls.

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