



COMPUTATIONAL ASSESSMENT OF A CYLINDRICAL TANK VEHICLE STRUCTURAL INTEGRITY

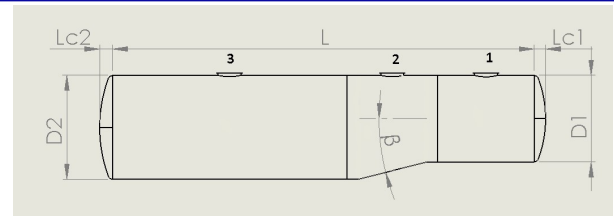
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Abstract The assessment of the static and dynamic properties of a tank vehicle is crucial and it is related to the three motions, namely longitudinal (driving and braking), lateral (guidance and steering), and vertical (suspension and damping). Since tank vehicles are mainly used for the transportation of dangerous goods, European Standards specify the minimum requirements for their design and construction. In the present study the structural integrity of a wedge-shaped tank vehicle with a cyclical cross-section and three compartments designed to have maximum payload, has been investigated using the finite element (FE) software ANSYS®v.17.0. Different FE models of the tank vehicle have been set up to investigate the influence of the diameters of the front and the rear shell end, the angle of the wedge shaped compartment and the overall length, in the structural integrity of the tank vehicle. The constraints for the aforementioned geometrical variables, as well as the loading cases, have been defined considering the corresponding Standards and the restrictions posed by the manufacturing procedures of such a tank vehicle. The outcomes of this study provide, among others, the structural integrity of such a tank vehicle with marginal geometrical values, offering a useful insight for tank manufacturers.

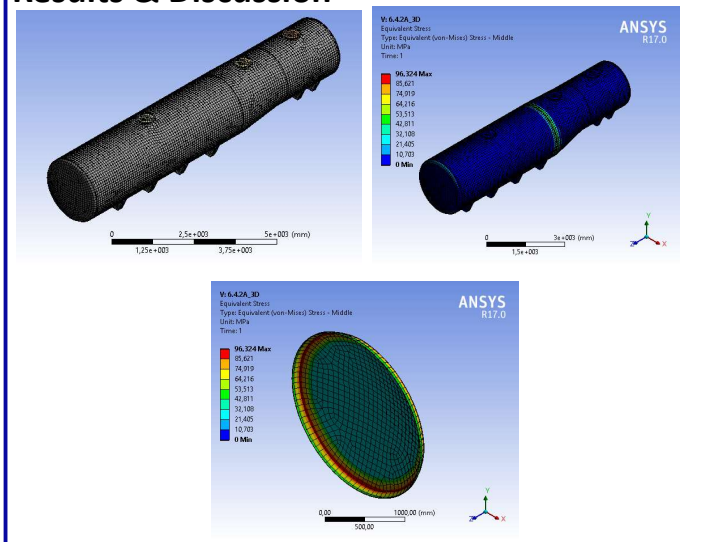
Keywords: Tank vehicles, Finite elements, Structural integrity, EN13094

Introduction Tank vehicles are many times used for the transportation of hazardous materials (flammable, toxic, corrosive etc). The safety regulations for vehicles carrying dangerous goods have been outlined by the “European Agreement concerning the International Carriage of Dangerous Goods by Road” (ADR)^[1]. If such a tank is metallic and its working pressure is not exceeding 0.5 bar its design and construction is also related to the European Standard EN 13094^[2].



| CFG | D2 (mm) | β° | L (mm) |
|-----|---------|---------------|--------|
| 1 | 2090 | 7.22 | 10468 |
| 2 | 2185 | 10.76 | 9826 |
| 3 | 2280 | 14.22 | 9259 |

Results & Discussion



Materials & Methods 3 configurations of a tank vehicle with a cyclical cross section and of wedge-shaped section consisting of three compartments and total payload of 35000 It are investigated in 7load cases.



Conclusions

- The components with the highest stress values are the partitions (knuckle radius)
- No loading case where high stress values are induced on the shell walls.
- The overall maximum stress value < 25% of the allowable stress.
- Contact areas (weldments) << Syweld
- Fatigue could trigger the cracks mentioned in the literature.
- In the loading cases which are implemented per compartment the compartment with the maximum length demonstrates the highest value of Von Mises stress
- In the loading cases which consider the tank carrying its maximum design mass increase of the diameter and decrease of the length results to increase of the Von Mises stress.