Design and Performance Evaluation of Chemical tanker at Spectra India

Mohammad Shahzad Akhtar[1] Mohammad Shakebuddin[2]
[1]M.Tech Student [2]Professor
[1,2]Department of Mechanical Engineering
[1,2]Anjuman College of Engineering and Technology Nagpur, Maharashtra, India

Abstract— The modern civilization is very largely dependent on the products of oil and massive quantities of oil / chemical are transported throughout the world. The design of vehicles transporting flammable fluid are important for public safety and economic implications. In this research we will develop a CAD model of tanker transporting the oil / chemical according to the dimensions provided by Spectra India, Nagpur and analyze the bursting pressure of tank using FEA.
Key words: Chemical /Acid tanker, analysis of tanker

I. INTRODUCTION

In the case of flammable fluid transportation. Society gain benefit from the use of these fluids, but also bear the certain risks in order to transport them from their place of production to the consumption point. To minimize the risk, considerable attention has been paid to the tanker which transport the fluid. In this project we will analyze the bursting pressure of chemical tanker using FEA to identify the current design of tanker can safely withstand the forces.

Fig. 1: Chemical tanker designed at SPECTRA INDIA

II. LITERATURE REVIEW

A. B Robinson, D Webb, J Hobbs& T London:

Vehicles used to transport large quantities of dangerous goods, including petroleum products, must meet the requirements of the European Agreement on the Carriage of Dangerous Goods by Road (ADR). Following examination, certain petroleum road fuel tankers have been found not to be fully compliant with the provisions of Chapter 6.8 of ADR. Amongst other things, the tanks were not radiographed during initial inspections, and those radiographed since are seen to exhibit extensive 'lack of fusion' indications in the circumferential welds that join the shell of the tank to the extrusion bands.

B. P.L. Barkana, Satish V. Ukkusurib,S. Travis Wallerb:

The design of vehicles transporting hazardous materials has important public safety and economic implications. Conventional wisdom among industry and government has held that a thicker tank on railroad tank cars and trucks reduces risk. However, a thicker tank increases vehicle weight and thus leads to an increase in the number of shipments required to transport the same amount of product and consequently greater exposure to accidents. In this research we develop a model that analyzes the tradeoff between increased damage resistance and greater exposure to accidents in which the objective function is minimization of the probability of release. The model accounts for the reduction in tank car release probability as a function of tank thickness, and the increased exposure to accidents that occurs due to the increased number of shipments needed for the heavier car. Three variables affecting this optimal thickness are considered in this paper: the volumetric capacity of the tank, the probability of release from other, non-tank sources, and the weight capacity of the car. Sensitivity analyses using the model indicate that for any particular configuration of tank car there is an optimal thickness. This optimal thickness is affected by several factors and there is no single optimum for all tank cars.

C. Tamrat Yimer:

Composite made tankers in Ethiopia uses in the last decade increase rapidly. Steel and plasticmade tankers replaced by these fiber glass tankers and many companies produce these tankers. But on this fiber E-glass, epoxy matrix tankers detected some failures due to many seasons. The main target of this paper reduces the failures shown on these tankers by creating suitable fiber angles of orientation produced optimal design of composite structure to with stand these failures. On this work the mathematical model of composite shell structure created. The solid modeling of twenty five thousand litters tanker is created by AutoCAD 2007 exported to ABQUS commercialsoftware to analyses the model. ABAQUS result shows on these fiber orientation compositestructure some failures will be on the joint between the dome and cylinder areas. This has to solve by strengthen the joint structure.

D. S. A. Usmani:

Chemical manufacturing is a non-stop process. Many of the chemicals are hazardous; still they are produced in large quantity. All sorts of safety measures and precaution can be taken at manufacturing stage. Next step is selling the products, which inescapably involves of transportation. Transportation of hazardous chemicals, therefore, is a serious subject as it not only involves a manufacturing but entire locality around during its transit. The movement of hazardous substances by any mode of transport involves a risk of accidental spillage of material or release of toxic chemicals. The petroleum and chemicals industries produce material having varied types of hazards, ranging from fire to explosion. Such products are transported in solid, liquid, or gaseous form under a wide range of temperature and pressure. The intensity of catastrophe is more when the mode of transport is by road to carry hazardous chemicals. It means chemical accidents would be more on the roads, and situation may go from bad to worse.

E. L. KalaniSarokolayi, B. Navayineya, M. Hosainalibegi, J. VaseghiAmiri:

Due to growing population and expansion of cities, the number of elevated water tanks supplying the demand urbanwater system is on the rise. As it has been mentioned in the Iranian code of practice for Earthquake /2800 becauseof the importance of sanitation and hygiene water tanks have been considered as important structures during theunexpected events such as earthquake. There is a great expectation not to see any phase out for their serviceabilityafter the earthquake. Because of the presence of fluid with different behavioral properties of structures containing itand the most part of mass of tanks are located in a considerable distance from its foundation, the behavior of thesetypes of structures in compare with conventional structures are more complicated. In this research, cylindricalconcrete water tanks, which have a central shaft, have been evaluated with considering the effect of the structure'sinteraction with water through precise implementation of boundary conditions on the interface between fluid andstructure. Also considering the level of water in the tank and their behavior under recorded acceleration of differentearthquakes using finite element method. The results were then compared with suggested methods by Iranian code/2800, which the results show a relatively considerable difference between mentioned methods.

F. S. Rammohan, S. Saseendran, S. Kumaraswamy[5]:

The objective of the present study is to provide a three dimensional analysis of flow through a globe valve with cage and plug design with emphasis on the inception and development of cavitation in detail. Cavitation reduction is achieved by breaking the flow in the form of more than one liquid jet, thereby increasing the turbulence inside the valve flow path. The k-epsilon model was used for turbulence. Results of five configurations of the cage with constant flow areas and valve stroke are presented in this paper. The numerical results were verified with an experimental program employing total flow measurement and pressure drop created by the valve at full opening. The study was conducted for different jet configurations to generalize the results of the study. Experimental validation was done in the water test facility with an operating pressure of 1.6 MPa and flow rate of 0.05 m3 /s.

III. DATA ACCUMULATION

Drawings of the existing tanker:

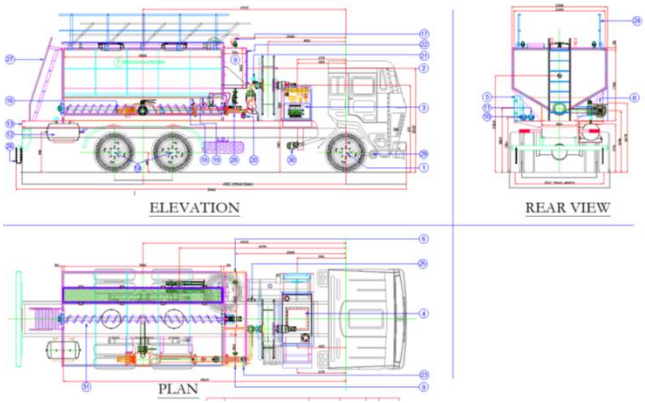

Fig. 2:

IV. NEED OF ANALYZING AND OPTIMIZATION

- During a visit to the SPECTRA INDIA, it was revealed that there is a requirement for analysis of a chemical/acid transporting tanker.
- The drawings were collected and analyzed to see the scale of work to be done.
- After a detailed conversation with the general manger it was decided that the existing designing needed to be modeled in a CAD software and FEA analysis was needed to be done in analysis software.
- By performing the FEA analysis we will be able to find the structural performance of the existing design and to identify the critical locations in the existing design.
- With the help of the FEA analysis we will be able to find out the bursting pressure for the existing tanker.
- With this project the company will be benefited from the advancements of computer technologies and thus will be able to improve its design of chemical/acid tanker.

V. RESEARCH METHODOLOGY

In present study, we create the CAD model of tanker. Then analysis of the existing design will be performed. Then bursting pressure analysis of existing parameters will be performed, Identify the significant parameters and optimization of identified parameters. Then analysis of optimized design will be performed in final stage and publishing of final design will be performed.

VI. CONCLUSIONS

With successful completion of this project, the company Spectra India,will be benefited from the advancements of computer technologies and thus will be able to improve its design of chemical/acid tanker.

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