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An Analytical Study on Blast Wall for Increasing Blast Resisting Capacity

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***Abstract*: Blast wall structures have significant role in oil and gas industry to protect people and structures against large explosion. This type of structure mainly made up of stainless steel. However, the presence of various uncertainties combined with a complex loading scenario effect the stability of the structure. Therefore, the structure needs an additional strength. In this paper explains that a new element added in the corrugated stainless steel blast wall and it increase the blast resistance in an economical way. Polyvinyl Chloride (PVC) is an important element, consider its properties along with stainless steel and it helps to improve stiffness of the blast wall. Mainly three type of core elements selected for this finite element analysis i) Trapezoidal core corrugated sheet ii) Rectangular core corrugated sheet iii) Square core corrugated sheet. New model developed using ANSYS and it is observed that using the method taken in this study can help to reduce the deformation of blast wall, which was more than fifty percentage of present deformation rate.**

***Keywords*: Corrugated Blast Wall, Stainless Steel, Polyvinyl Chloride, Sandwich panel**

1. Introduction

Gas blast is the most regular accident happening in the oil and gas industry, all security related to the basic components on the topside of offshore platforms should hold their strength against blast load. Though impressive exercise has been devoted to develop impact safe plan strategies for offshore structures. In inland and toward the ocean oil and gas workplaces have various possible unsafe conditions. For instance, hydrocarbons are dealt with. In spite of the way that the situations are exceptional, the outcomes can be truly hurting to the structure, work power and even open prosperity. Therefore, the offshore platforms are planned to construct with blast resisting structures. Previously, various blasts have occurred at oil and gas industry. Severe principles have been created throughout the years for impact safe structure are still of significance in present days. On the first of December 2016 an immense flame blast happened at one of the greatest petroleum processing plants in Italy, Piper Alpha Explosion in the south of Milan shown in Fig. 1, of which the outcomes to general well-being are still start surveyed.

Concrete is utilized for land based blast resistant structures, because of its tremendous weight and high stiffness. In seaward conditions, alternative structural configurations are required as weight is a significant factor in structure. Among other potential methods for assurance against blasts, blast walls have lower cost to strength proportion and can be installed very quickly. Blast wall structures can be framed of stiffened or unstiffened panels however; treated stainless steel walls have progressively been utilized in the offshore structure because of their excellent energy absorption and temperature dependent properties and considerable ductile ability and good corrosion and fire resistance properties. In this manner, the necessities for seaward blast walls are progressively through; they should be light, strong and ready to maintain their integrity during blast events. A typical structural configuration for corrugated profiled blast wall is shown in Fig. 2.

Fig. 1. Piper Alpha explosion, Offshore explosion accident

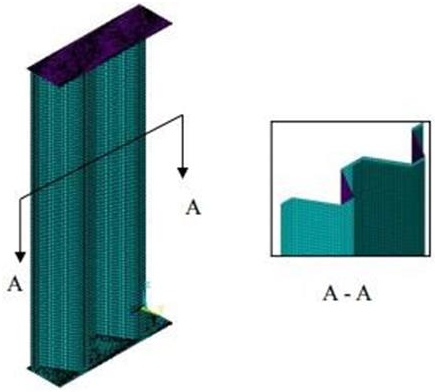

Fig. 2. Typical structural configuration for corrugated profiled blast wall

2. Method

Best effective way to enhance the blast resistance of corrugated sheets, blast wall was developed by Polyvinyl Chloride (PVC) foam. For that PVC foam filled in between two

stainless steel sheets and one core corrugated stainless steel plate placed in the exact center of PVC foam. These structures consist of two strong, hardened, thin face sheets and corrugated core centers and that total element looks like sandwich structures. The blast resistance of the corrugated blast wall element could be generally improved from the addition of PVC foam filling, due to the improvements of buckling resistance and bending rigidity of the foam-filled corrugated core. This paper shows the conceivable utilization of Polyvinyl Chloride (PVC) froth as filler to upgrade the blast resistance of stainless steel corrugated core sandwich panels in offshore structures.

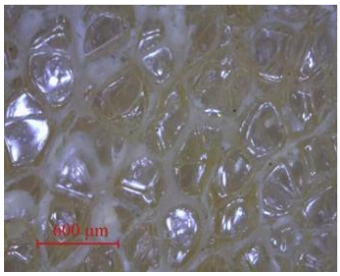

Fig. 3. Microscope image of closed-cell Polyvinyl Chloride polymer foam

3. Objectives

The aim is to create the effective blast resistant walls with suitable core shape in an economical way. As part of the need of the project numbers of goals were produces to measure the success of the project. The main objectives of this project are as follows:

1. To obtain a detailed 3D FE model of PVC foam filled blast wall structure
2. To find out the resistance capacity of blast wall after filling Polyvinyl Chloride polymer foam

4. Finite element analysis

In order to increase blast resistance of the structure a finite element modal of blast wall created in ANSYS for transient dynamic analysis.

Table 1
Geometric properties of corrugated blast wall (All dimension are in mm)

Property	value
Thickness, *Tw*	11
H	554
L_1	200
L_2	320
L_3	240
X	6000
End plate thickness	12.5

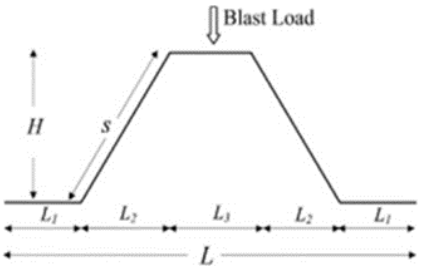

Fig. 4. Geometry of corrugated blast wall

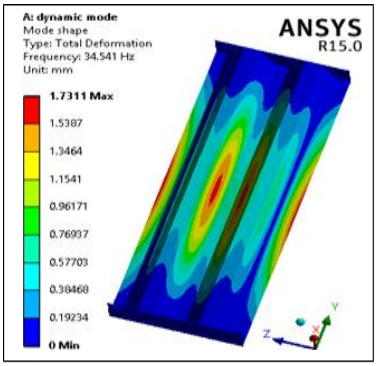

Fig. 5. Finite element model of corrugated sheet without Polyvinyl Chloride polymer foam

Additional adding material, Polyvinyl Chloride (PVC) has density of 250 Kg/m^3 with poisson ration of 0.4. compressive and tensile strength was 7.2 and 9.2 MPa respectively

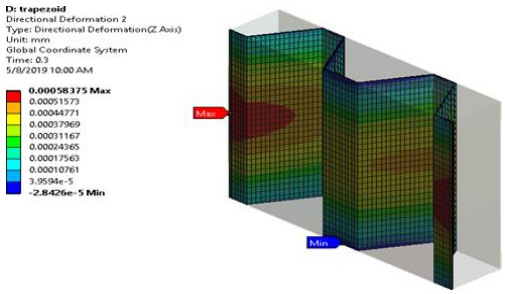

Fig. 6. Finite element model of corrugated sheet after applying PVC foam

5. Conclusion

In steel corrugated blast wall have Max deformation of 20 mm is noted at 0.13 second (References journal) but after applying Polyvinyl Chloride polymer foam the deformation reduced to 0.35 mm (Finite element model). So it shows huge difference in the case of blast resisting capacity of blast wall.

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