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Study of Silo Using Relief Shelf at Various Locations Using STAAD-PRO

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ABSTRACT

In this study the magnitude of reduction in total active pressure, hoop thrust at the bottom level and its distribution after using relief shelfs at junction of chamber of hopper bottom. Silo is considered as the member which is subjected to hoop thrust like water tank. Numerical study is conducted to investigate the effect of the number of shelfs, wall rigidity, vertical pressure, horizontal pressure and its dynamic effect's. Pressure quantity, the maximum acting bending moment and shear force on the wall are also discussed to perform the designing process. Currently numerical analysis is the time savior method, it will also reduce the money which will used in the experimental work. According to the analysis it was found that relief shelfs have excellent effect on the spreading of the internal pressure or hoop thrust. The numerical result show that relief shelfs used inside the silo would result in reduction of the internal pressure or hoop thrust also also result show that the shelfs plays a positive role as pressure distributor for silo.

Key Words: Bunker & Silo, Effective dynamic pressure, Rupture surface, Single, Double, triple Relief shelfs, Effective design, Best location.

INTRODUCTION

The term 'Silo' includes deep bins and shallow bins, the latter usually referred to as bunkers. Though, the term 'Bin', 'Silo' and 'Bunker' have dissimilar meaning in diverse portions of the ecosphere. Actually the term 'silo' represents deep bins. From the physical and architectural fact of view, circular silos are also more pleasant looking. Although circular form costs more but requires less construction material compared to other shapes.

Bins are constructed moreover of RCC or sheet metal, the dual different methods of construction importantly influencing the comportment of the storage tower. A concrete bin will not buckle in the same way as a metal silo, nor will a metal silo burst or suffer the same cracking effects as a concrete one under bending and tensile forces. A concrete silo is, however, meaningfully additional resilient to scratchy ingredients, such as petroleum and iron ore, but a metal bin is much more well-organized in terms of substantial use for storage smaller particle granular solids, such as cereals. Only thin- wall metal silos, specifically steel, are considered in this thesis since these are usually more common and have suffered numerous catastrophic buckling failures under eccentric flows in the past.

Whether steel or concrete silos will prove more economical for a specific application be contingent. On many factors counting cost, size, complexity of the structure, site of silos and problems of delivering construction material to the site. Storage tower are usually spherical in cross section. For self-cleaning and for draining it is maintained on a numeral of pillars, by the way of a circle beam. Its lowest tallness is fixed in such a way that a truck can pass through the bottom. It's enclosed with shallow sphere-shaped or tapering dome or with a beam and slab type flat roof with appropriate main hole. Further the silos may be classified as Flat lowest silo, Hopper lowest bin and Truck load silo based on the requirement of storage of materials and delivery of materials. The deposited substantial applies pressure on the lateral of a structure. This pressure differs throughout filling and discharging and also with the position of the clearing slum. It is difficult to analyze the pressure because of many factors. Hence approximate methods are followed which are suggested by Janssen and Airy.

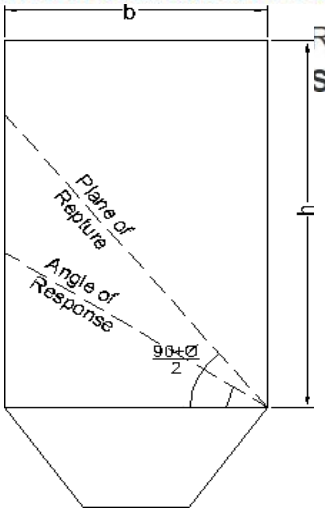

Figure 1:- Elevation of Silo

OBJECTIVE OF THE WORK

The objective of this project work is to analyze the design of steel silo and concrete silo by using the software i.e. STAAD-PRO. And the relief shelfs can also be used as pressure relief shelfs at different level of cylindrical wall of RCC silo. The investigations did here targets to reduce the lateral pressure of silo wall by using 0.25m, 0.5m, and 0.75m of relief shelfs at different level of silo wall.

In subsequent report comparison of structural analysis of silo along with different position of Relief shelfs are studied in detail:

1. To study literature review on steel silos and concrete silos.
2. Prepare different type of designs of silo with and without relief shelfs using STAAD PRO.
3. To compare silo with and without relief shelf at different level.
4. To compare plane modal relief shelfs attached model using STAADPRO.

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Table 1: Horizontal Pressure Without Relief Shelf

S.No.	Height From the top	Pressure in emptying	Pressure in filling	Hoop Tension (T)	Ultimate Hoop Tension (T_u)
1.	4	22.68KN/M^2	12.97KN/M^2	62.32KN	93.48KN
2.	8	32.16KN/M^2	20.33KN/M^2	88.44KN	132.66KN
3.	12	36.12KN/M^2	24.50KN/M^2	99.33KN	148.99KN
4.	14.5	37.32KN/M^2	26.14KN/M^2	102.63KN	153.95KN

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Result:-

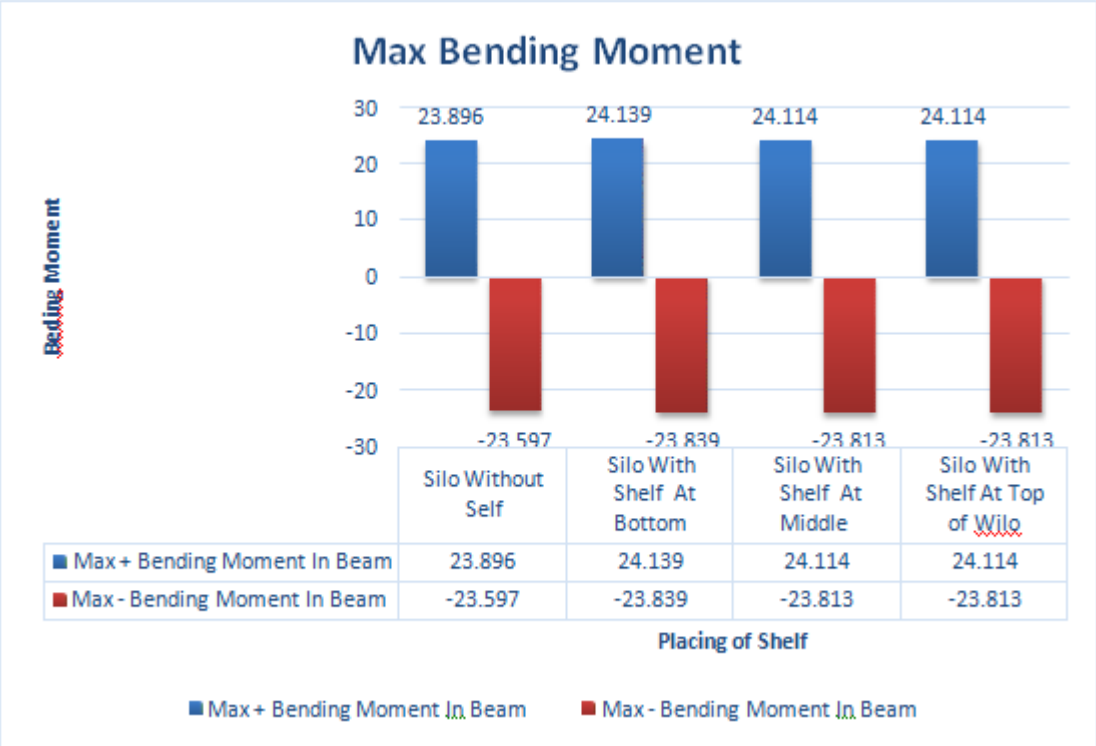

Fig.1 Max. Bending Moment In Beam With & Without Presence of Shelf

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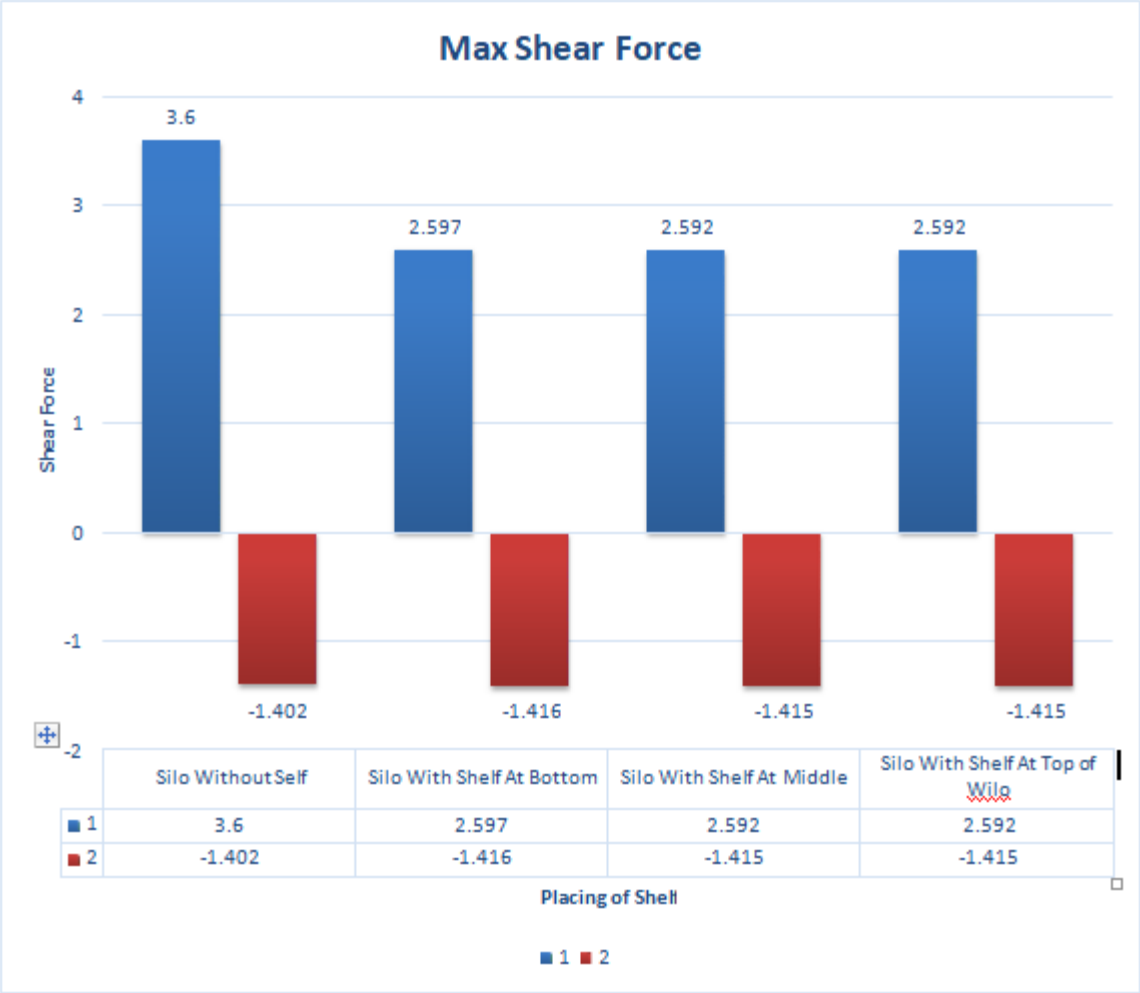

Fig.2 Max. Shear Force With & Without Presence of Shelf

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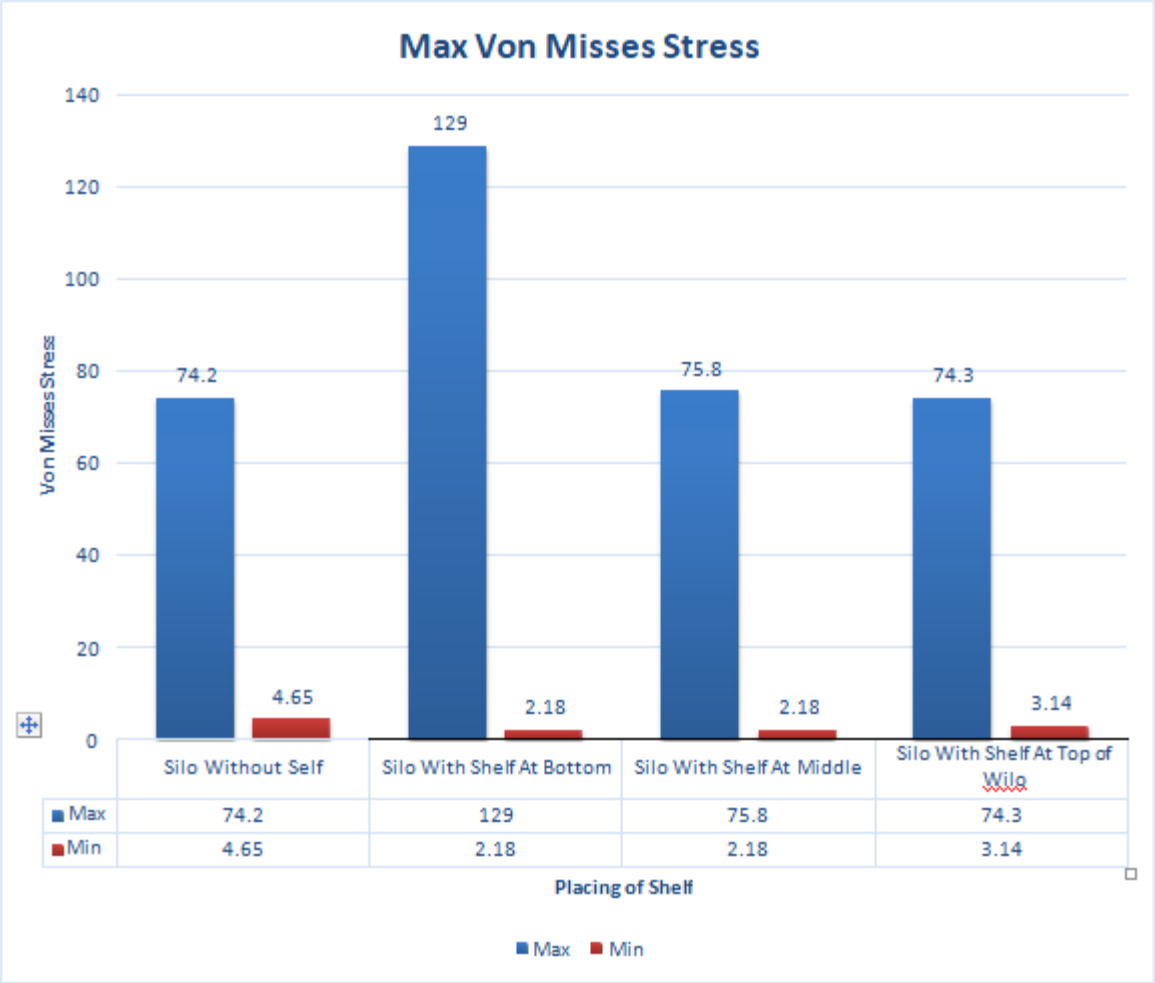

Fig.3 Max. Von Misses Stress With & Without Presence of Shelf

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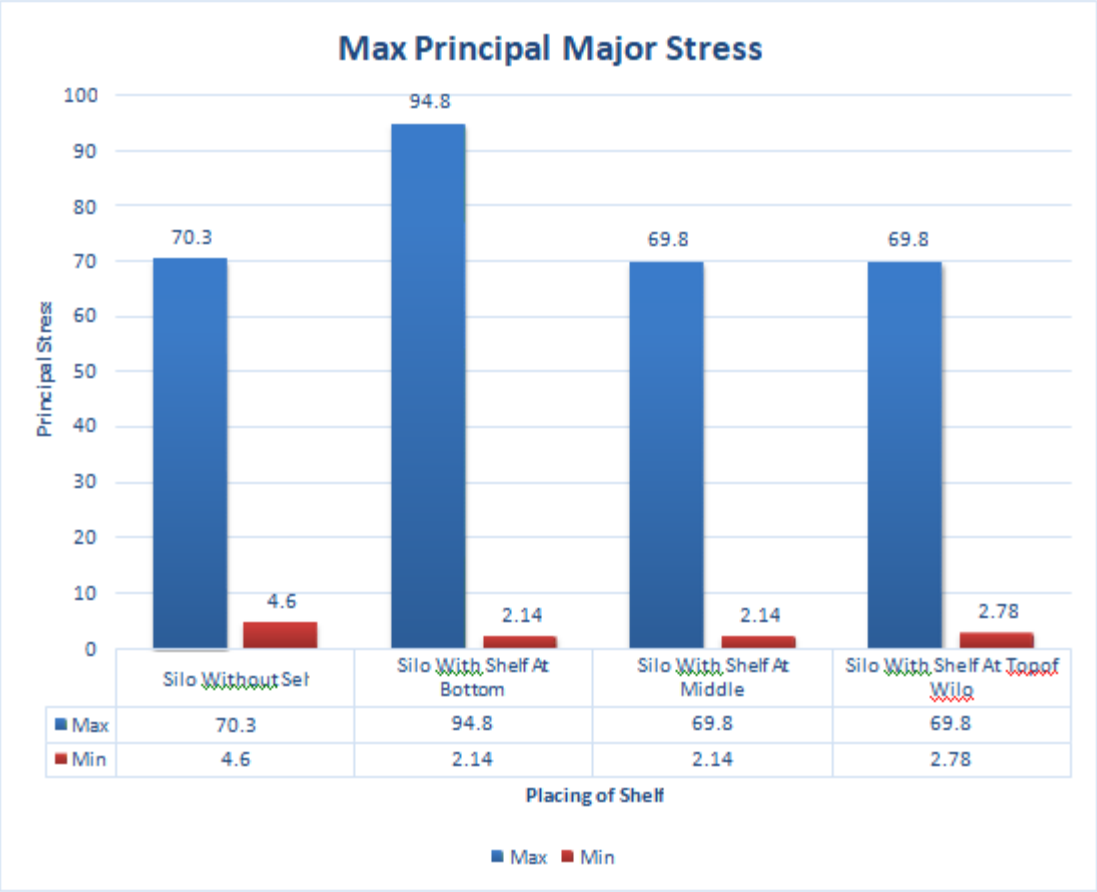

Fig.4 Max. Principal Major Stress With & Without Presence of Shelf

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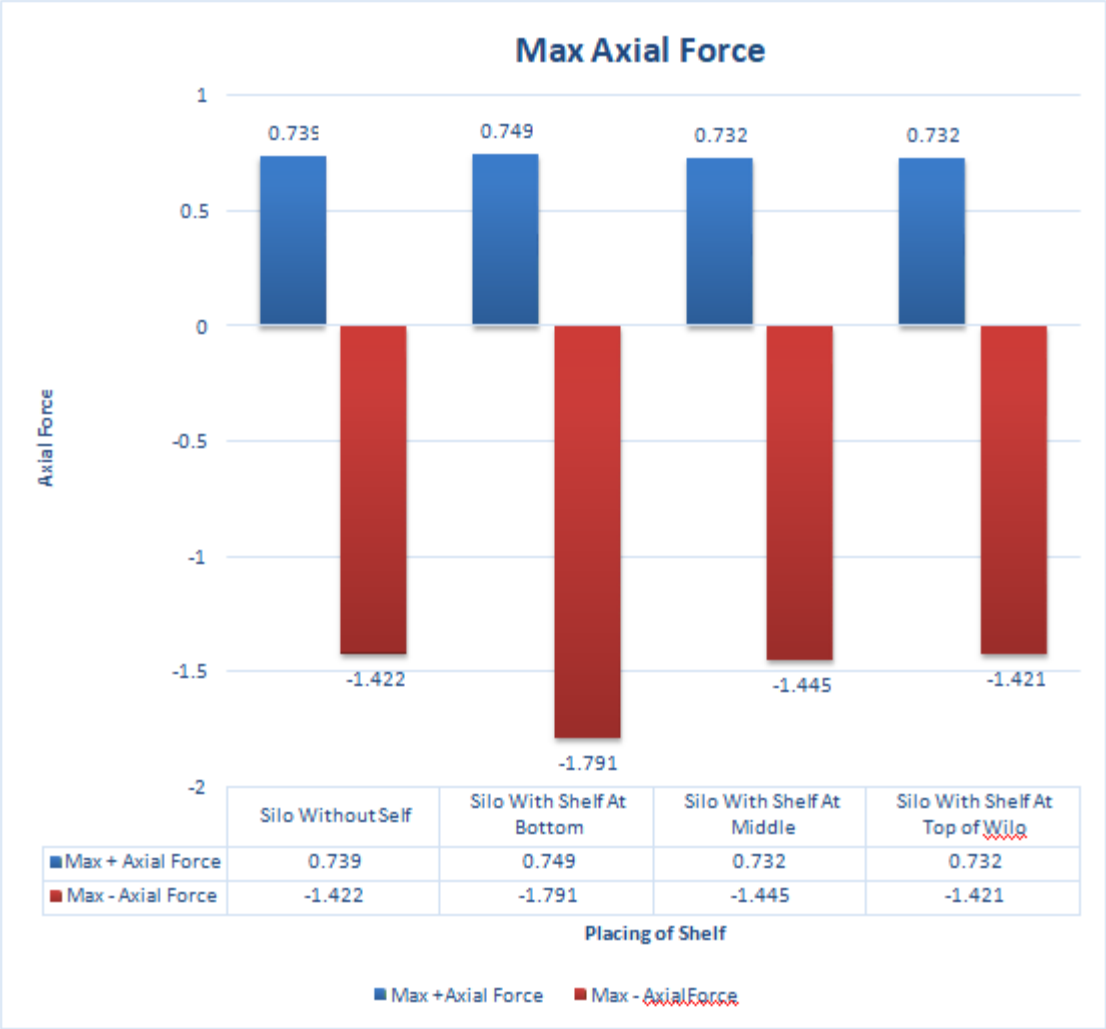

Fig.5 Max. Axial Force With & Without Presence of Shelf

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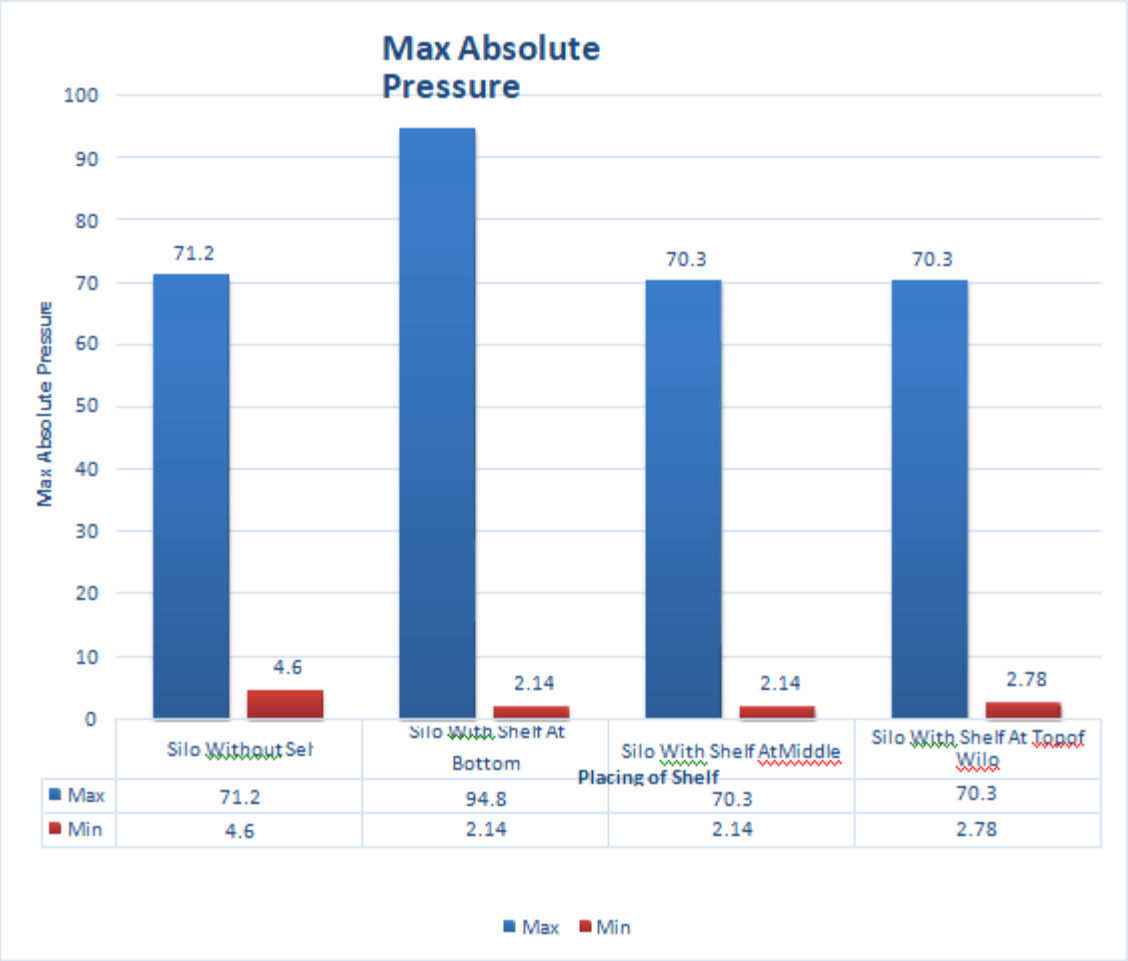

Fig.6 Max. Absolute Pressure With & Without Presence of Shelf

Conclusion-

The question of determination of horizontal & vertical pressures against the RCC silo is one of the oldest in civil engineering field. RCC silo with pressure relief shelfs is one of the special types of silo particularly high R. C. C. silo may be used economically by providing relief shelfs at the different positions of silo wall. Such silos may be termed as the "RCC silo with Pressure Relief Shelf". The study of RCC silo **with** pressure relief shelf is somewhat an **un-noticed** area in the field of Geo-technical Engineering. In the present study an attempt has been made here to study the behavior of a RCC silo with one or more relief shelfs at different positions and a theory has been proposed which agrees fairly well with experiments conducted on a

model. The instrumented model of silo is developed and studied for; horizontal and vertical pressure measurement on RCC silo without and with single relief shelfs for different width factor and location factors. The pressure measurement on RCC silo when a single relief shelfs with a particular width and location factors. The various factors of silo are also analyze with and without relief shelf. Measurement of deflection of silo wall due to storage of material, A computer program is also developed for the design of RCC silo with and without single **pressure** relief shelf. Various design problems are analyzed and comparative **study** has been carried out.

Conclusions are carried out:

- "RCC SILOS with shelfs" are economical compared to conventional "RCC SILOS without shelfs".
- The economic shelf locations for RCC SILOS with single shelf is at 4m, 8m, 12m respectively from top, where H is height ofstem.
- The economic shelfs locations for RCC SILO wall with two shelfs are, the 1st shelf at 4m from top of the stem, the 2nd shelf is at 8m and 3nd shelf is at12m.
- In a RCC SILO with shelfs, as the height of the wall increases, percentage saving of materialincreases.
- RCC SILO with three shelfs are economical as compared to RCC silo without relief shelf.

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