

A REVIEW ON PARAMETRIC STUDY ON DESIGN OF SILO

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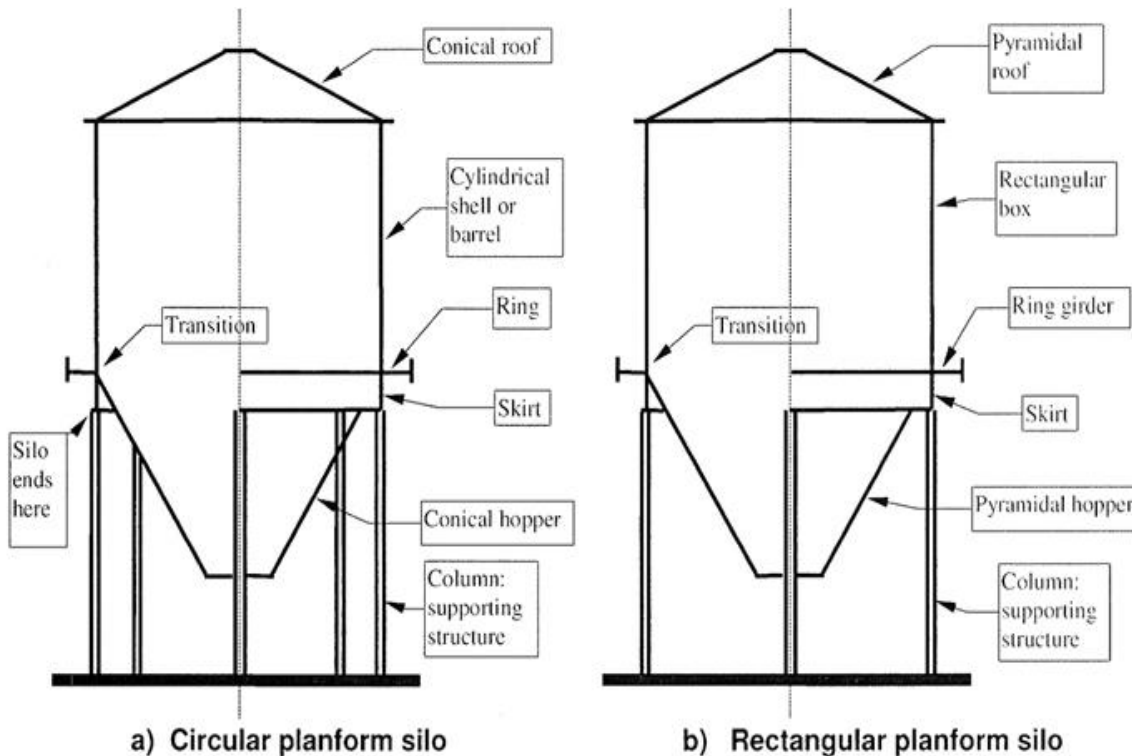
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Abstract: In this paper parametric study mainly based on variation of actual pressure with change in hydraulic mean radius which ultimately depends upon the nos of compartments. Here pressure not include only static pressure but also include possibly pressure increases caused by filling, withdrawal of material, arching, collapse of arch material, aeration and eccentric discharge. Here consider the different theory for static pressure like janssen's and airy's theory and also take different standard like janssen's method by ACI and IS Approach.

Keywords- parametric study, silo

I. INTRODUCTION

Structure for the storage of solids is generally referred to by the name Bin. A bin is simply an upright container and the name includes shallow containers known as bunkers and tall structure known as silo. Silos are more commonly used for bulk storage of grain, coal, cement, carbon black, woodchips, food products and sawdust. Three types of silos are in widespread use today: tower silos, bunker silos, and bag silos.



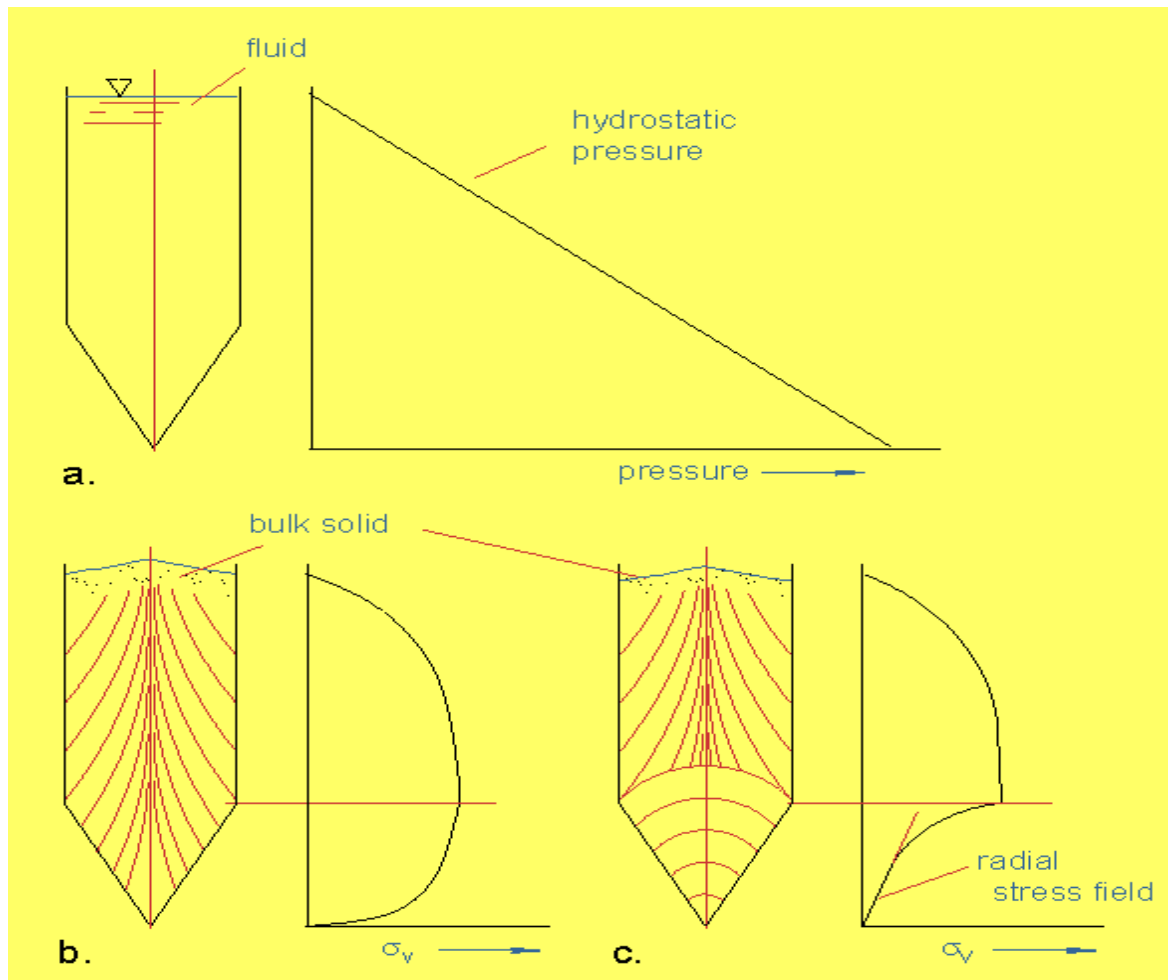
II. LITERATURE REVIEW

A. STORAGE OF POWDER AND BULK SOLIDS IN SILOS by Dietmar Schulze

Problems with the storage of bulk solids in bins and silos can be avoided if they are designed with respect to the flow properties of the bulk solid which has to be stored. The paper considers the basic rules for the design of silos.

Figure shows silos and the pressures and stresses, respectively, acting in the silos. While the pressure (for fluids we will use the word „pressure“) would increase linearly downwards if the silo would have been filled with a fluid (a), the course of the vertical stress (for bulk solids we will use the word "stress") in a silo filled with a bulk solid is rather different (b,c): In the latter case in the vertical (cylindrical) section of the silo the vertical stress increases in a digressive way. If the height to diameter ratio of the silo is sufficiently large (usually: > 3), a constant vertical stress is attained. This means that the vertical stress will not increase further even if the filling height is much larger.

The reason for this course are the shear stresses acting between the bulk solid and the silo walls even if the bulk solid is at rest. Due to the shear stresses, the silo walls carry a part of the weight of the bulk solid. A method for the calculation of the stress course in the vertical section was derived by Janssen already in 1895. This method is the basis for most present standards for the calculation of the load on silo walls for structural silo design.



The design of silos in order to obtain reliable flow is possible on the basis of measured material properties and calculation methods. Because badly designed silos can yield operational problems and a decrease of the product quality, the geometry of silos should be determined always on the basis of the material properties. The expenses for testing and silo design are small compared to the costs of loss of production, quality problems and retrofits.

B. STUDY OF HORIZONTAL PRESSURE ON WALL OF CIRCULAR AND VRATTAYATA SHAPE SILOS by L.M. Gupta and N.V. Deshpande
(Indian Concrete Journal Vol.77)

This paper deals with Janssen's theory for computing horizontal pressure exerted on silo wall due to stored material at rest. The computation of pressure at various elevation of the wall is made for Circular and Vratayata shape silos. The dimension of this silo is so selected such that they have the same cubical content. The curve have been plotted to study the effect of hydraulic radius on the horizontal pressure at certain depths.

Geometrical properties of silo shapes:

Circular silo having diameter of 12m and height of 30m is selected for the study

$$A = 0.25 \pi \times D \times D$$

$$P = p \times D$$

$$R = 0.25 D$$

$$V = A \times H$$

Vratayata silo:

The 5m, 5.5m, 6m radius of semicircular portion for Vratayata silo is considered with varying straight length. Five combinations are studied for each of the radius. The volume content in each silo kept same as that of circular silo.

The study has been made for the effect of hydraulic radius on horizontal pressure when the material is at rest. For this, the depth of 12m, 21m, 24m, and 27m has been selected.

CONCLUSION

For study of horizontal pressure vs. depth

1. For all chosen dimension of Vratayata silos, at rest the horizontal pressure is more than that of circular silo at the same depth.
2. The observed change in pressure is more at the depth of more than 18m
3. Even though the horizontal pressures at various depths are calculated using exponential relationship, in some of the cases the curve between the depth v/s pressure fits more accurately into the 4th degree polynomial relationship.

C. DESIGN OF SILOS FOR FLOW AND STRENGTH by Peter c. Arnold

Too often in the design of silo systems for the storage and handling of bulk solids those involved in the Various components of the design process do not communicate. Even if all the designers communicate well the overall result may disappoint if the project manager allows significant (but sometimes subtle) design variations during construction. The result can be a system that does not perform well. Had there been some consistent communication between the competing interests throughout the design and construction phases many of the limitations on performance would have been avoided. This paper highlight some areas where lack of communication can have an adverse effect on good performance.

The necessity of taking a co-operative approach to the design of bulk solids handling plant cannot be Over emphasised. In the design process considerable attention and a large component of the budget is expended on ensuring that the processing units perform their proper function. Budget overruns on the processing units often means that materials handling systems which link the total system together are the targets for cutting expenditure. As the total system is normally a series linked system with the processing units linked by materials handling components then the end result is that the total system has severe weak links. It is also vital that the structural engineers are aware that the silo structures they design are to contain bulk solids. The interaction of the bulk solid with the silo structure needs to be constantly born in mind so as to aid in avoiding silos structures that fail and/or perform their storage and handling functions poorly.

III. CONCLUSION

- I. The pressure variation directly proportional to the hydraulic mean radius which ultimately dependent on nos of compartments.
- II. Lateral pressure by ACI approach gives more conservative results but ACI Code does not give any idea regarding the overpressure factor especially for compartment silo.

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