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SILO FOUNDATION DESIGN

DESIGN OBJECTIVES

- Eliminate differential settlement
- Eliminate underground structures
- Achieve the above economically
- Limit risk
- Improve integrity of budget costs

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DIFFERENTIAL SETTLEMENT

All structures settle to a greater or lesser degree depending on;
- ground conditions
- ground treatment
- Design considerations

Even small differential settlements of silo floors, tunnels and ring beams can render the silos unusable due to extraction problems, particularly when sweep augers are employed.
In some cases remedial measures are relatively easy and low cost, but we have seen significant damage requiring costly repair or replacement.
Ascon's approach is to rather significantly reduce the probability of differential settlement at the design stage.

GROUND CONDITIONS

Subterranean conditions are almost impossible to predict, even when tests are carried out, which rarely happens before budget costs are finalised and contracts awarded. This nearly always results in cost and time overruns.
Large silos exert significant loads on their foundations, which in most cases are articulated, and therefore prone to differential settlement.
The solution to eliminate differential settlement is to de-articulate the foundation so that any settlement would be uniform.
Piling the entire unified structure is one way to achieve this, but is thought by many to be expensive and time consuming. Therefore raft foundations became attractive.
Raft foundations require excavation as bearing capacity usually increases with depth. Typically founding at 3m depth is sought as this conveniently allows a tunnel to be fitted between the top slab at ground level and the raft. Sometimes greater depths are required if the ground is weak. But even at 3m depth for example, a 5000MT silo with a diameter of 19m, would need a raft with a diameter of 28m to achieve an imposed bearing of 150KPA, which is considered to be the minimum bearing capacity required.

A number of options exist for strengthening the ground beneath the foundations, but these are likely to be expensive and time consuming, and unique to the prevailing conditions.

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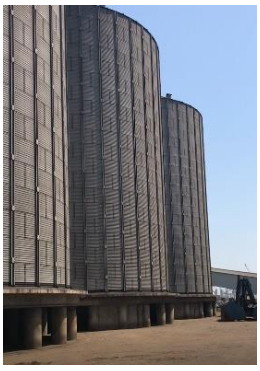
DESIGN CONSIDERATIONS

If an articulated solution is being adopted, the design would need to ensure that the bearing capacity of the ground was similar at all points of interface, and that the imposed loadings were uniform. This would indeed be a challenge as the behaviour of grain in a silo and the loads it imposes on the various elements of the silo are complex. The vertical load on the wall from the grain, and that on the floor of the silo will vary from silo to silo in terms of aspect ratio, filling, discharging or static, and what the wind is doing.
A de-articulated foundation can cope with these variables far easier, whether a raft solution is adopted, or piling.

Important to note:
The concrete foundations generally are 75% of the total silo cost, including the steel silos.
It is important therefore to consider the foundation design as well as the silo supplier when selecting options, particularly if cost is an issue.



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ABOUT US

Ascon Africa is a privately owned independent **E**ngineering, **P**rocurement, **C**onstruction and **M**anagement firm (**E.P.C.M**), originally established in Zimbabwe in 1959. It operated as part of the Scott Wilson International Group from 1983 to 2004, before reverting back to Ascon Africa.

Ascon Africa offers diverse infrastructure development professional services and construction, throughout Sub-Sahara Africa, utilizing the decentralized methods of management in order to ensure independence to harness and maximize associated expertise.

Our team comprises professionals who possess extensive experience in their respective fields of infrastructure development.

Ascon Africa also associates itself with reputable firms in other sectors in order to strengthen its project delivery capability and increase its capacity. It is our extensive knowledge as well as the understanding of continuous business transformation that puts us in the forefront of our competitors.

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