THE UNIVERSITY OF NEWCASTLE AUSTRALIA

TUNRA BULK SOLIDS

Silo Quaking Analysis on Wheat Conditioning Silo

Project Scope:

Bulk Material: Wheat

Equipment: Wheat Conditioning Silo

Problem: Silo quaking problems experienced in a 200 tonne wheat conditioning silo.

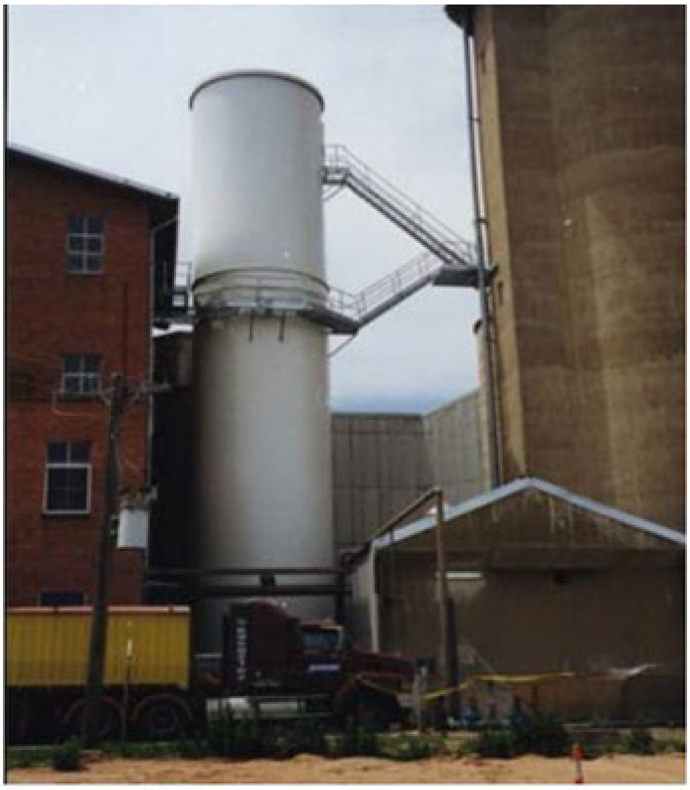

Figure 1: 200 Tonne Wheat Conditioning Silo

Wheat is dosed with water prior to being fed into the top of the silo, the objective being to bring the wheat to a uniform moisture content of around 16% prior to discharge for the subsequent milling process.

The magnitude of the shock loads was quite severe, particularly when the silo was full or near full. Observation showed the shock loads were transmitted through the ground into the neighbouring concrete silo structure leading to some cracking.

Calculations showed that the vertical dynamic load for the full silo, when discharging grain amounted to 30% of the full static load, thereby increasing the total vertical load to 130% of the static load. The load analysis indicated that, if the silo is operated at reduced head or fill, the shock loads are significantly reduced. For instance, at 60% full, the dynamic load is 46% of its maximum value, whereas at 50% full, the dynamic load is only 21% of its maximum value.

Operating at 50% full would be the preferred option provided the residence time of the wheat in the silo is still sufficient to achieve good conditioning.

The vibration frequency of the silo structure due to the vertical motion and swaying varies with the degree of fill. The fundamental natural frequency of the silo when 100% full is estimated to be 40% of the corresponding frequency when the silo is empty.

Recommended Solution

To attenuate the growth in shock wave amplitude up the silo, experiments were conducted using a hopper insert. In effect, the insert divides a tall mass-flow silo into two squatter mass-flow silos. The results show the acceleration amplitude above the insert is reduced by approximately 50%

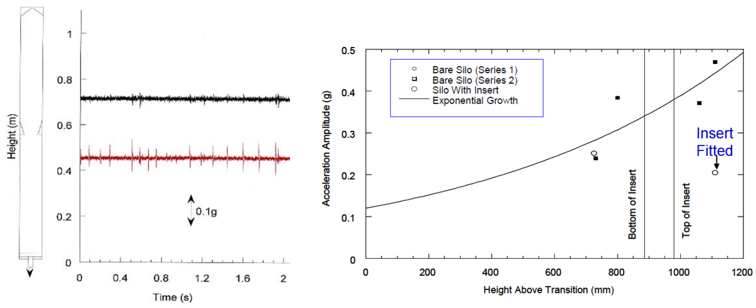

Figure 2: Influence of Hopper Insert in Reducing Acceleration During Discharge

The proposed solution for the silo is shown in Figure 3. It needs to be noted that the insert will cause an increased normal, switch type pressure on the silo wall and, consequently, the silo wall needs to be strengthened in this region. This is illustrated by the stiffening ring shown in Figure 3:

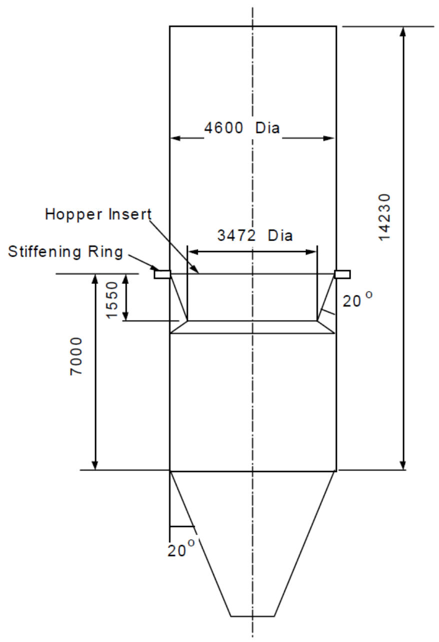

Figure 3: Modified Silo Showing Hopper Insert

Why TUNRA Bulk Solids?

Experience and Expertise
We have provided expert solutions to industry for over 45 years and are the leading organisation for materials handling research and consulting in Australia and internationally

Research and Development
We have a proven track record in research and development through the close association with The University of Newcastle

Quality Service
We have highly qualified, well-trained and specialist staff that are committed to delivering excellence

First Class Facilities
Our laboratory is a state of the art facility located within the Newcastle Institute of Energy and Resources (NIER) at The University of Newcastle

Industry Standards
We are accredited to ISO 9001, ISO 45001 and ISO 14001

Independent
We are independent and not for profit

Advancing the Bulk Materials Handling Discipline Globally

Further information

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- To discuss your industry and business needs **phone 02 4033 9055**