



Train Load-Out Bin Analysis

Project Scope:

Train Load-Out Bins are critical to the operation of mine sites. The load-out station is often one of the most important links to the handling chain, and any downtime with the load-out station directly impacts export tonnes. To ensure an effective train load-out bin design, the following analysis is recommended:

- Study of material flow properties to be handled by the bin. This information can be used to calculate wall angles for mass flow, or to determine the optimal design if funnel flow or expanded flow is to be used.
- Dynamic load calculations for the loads due to the central core, slumping loads and also loads on the chute.
- Silo quaking analysis to determine critical frequencies and range of quaking loads that may be experienced.



Figure 1: Train load-out bins

Silo Quaking:

Silo quaking is a phenomenon that is particularly prevalent in train load-out bins. This is due to the very large load-out rates that are needed to fill the wagons quickly. Further research is still required to fully understand this complex mechanism, but there is a simplified

approach which has been used previously, and has correlated well with on-site measurements. This approach includes both an analytical TUNRA approach developed by Prof Alan Roberts, as well as the Discrete Element Method (DEM). By using these methods it is possible to make calculations for load frequency and load magnitude.

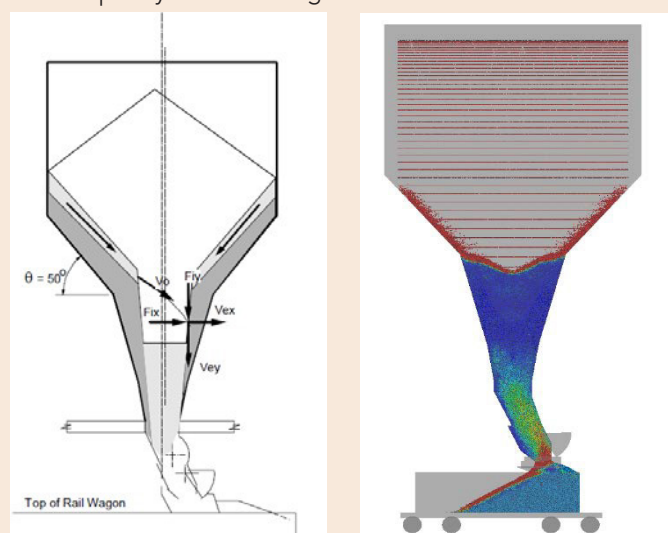


Figure 2: (A) Load Analysis

(B) DEM Modelling

Load-Out Patterns:

The load-out rate from a bin is such that there is a large initial surge of flow, as high as 40,000 – 60,000 tph, and then choked flow occurs to fill the rest of the wagon. Calculations can be made for flow rates and volumetric filling of the wagon over time.

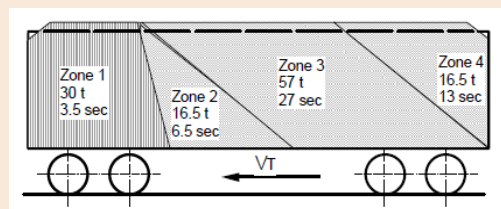


Figure 3: Analysis of load-out bins and filling of wagons

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