



## Re-Design of Nickel Ore Hopper

### Project Scope

**Bulk Material:** Nickel Ore

**Equipment:** Road receival hopper

**Problem:** Arching and ratholing due to difficult nature of material, resulting in blockage and downtime

**Aim:** Conceptual re-design to improve flow and reliability

A flat bottomed road receival hopper, acting as the entry point to a nickel ore handling facility, was observed to arch and rathole. This resulted in sporadic flow (surges), blockage and ultimately costly downtime for the client. The existing hopper and feeder/breaker arrangement (hopper floor) is shown in Figure 1.

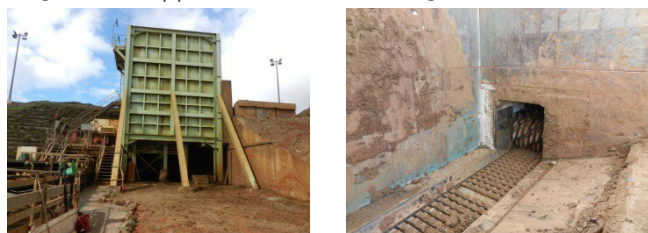


Figure 1: Existing Hopper, Feeder and Breaker



Figure 2: Arching and Ratholing on Site

The ratholing, arching and blockage as observed on site is shown in Figure 2. Due to client request, conceptual re-design was restricted to not modifying existing geometry which included the feeder/breaker.

### Flow Properties and Conceptual Re-Design

Upon completion of flow property testing at TUNRA laboratories, a redesign was proposed in view of existing constraints. The nickel ore sample proved to be a very difficult to handle with high internal friction, wall friction and critical arching dimensions exceeding the width of the existing feeder. Also observed was high cohesion and propensity to adhere to all wall lining materials considered. This was further compounded by structural restrictions set out in the design criteria. Both the existing and the TUNRA proposed insert design are shown in Figure 3. The inserts were developed to fit into the existing geometry, with maximum possible opening at the feeder interface and half hopper angles selected to ensure mass flow.

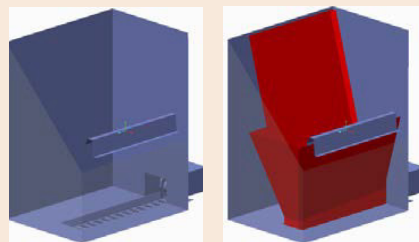


Figure 3: Existing Hopper and Proposed Inserts

### Project Outcomes and Numerical Modelling

The insert concept was slightly modified during detailing to accommodate the open ended nature of the hopper. To ease manufacture, variation to the feeder interface was also performed. Feedback received from site indicates elimination of ratholing (dead zones) and deviation in throughput has halved. However, while occurrence has decreased, arching (bridging) still develops during handling of quite wet product. These observations are in good correlation with modelling shown in Figure 4. Results indicate propensity for ratholing with the existing design which diminishes when the mass flow insert is incorporated.

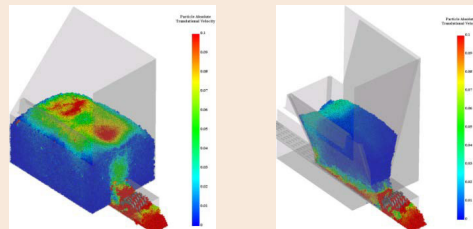


Figure 4: Flow Through Existing and Re-Designed Hopper

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