THE UNIVERSITY OF NEWCASTLE AUSTRALIA

TUNRA BULK SOLIDS

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.

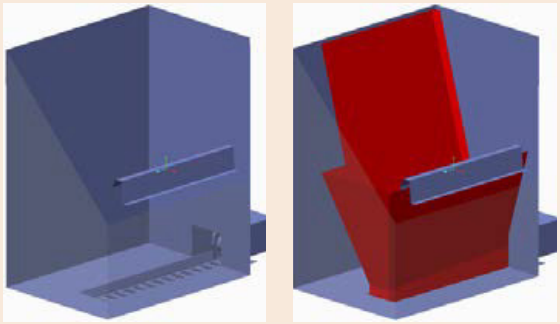

Figure 3: Existing Hopper and Proposed Inserts

TUNRA Bulk Solids conducts custom tests to suit the individual needs of our clients

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.

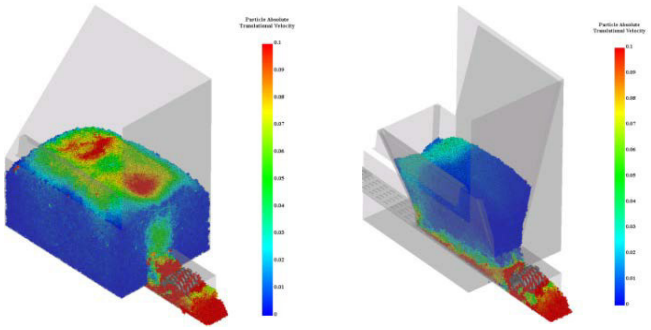

Figure 4: Flow through Existing and Re-Designed Hopper

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

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