CASE STUDY

ROCKY

# Hatch improves iron ore flow and reduces blockages in a rail tippler using Rocky DEM

"With Rocky DEM's breakage model, we were able to discover how little lump breakage was occurring and what was needed to break the lumps up sufficiently for the iron ore to pass through during the tippler operation. These are key insights that will help optimize the equipment to reduce blockages and make sure the material moves more effectively and efficiently."

***Luke Stone***

*Mechanical Engineer, Hatch Australia*

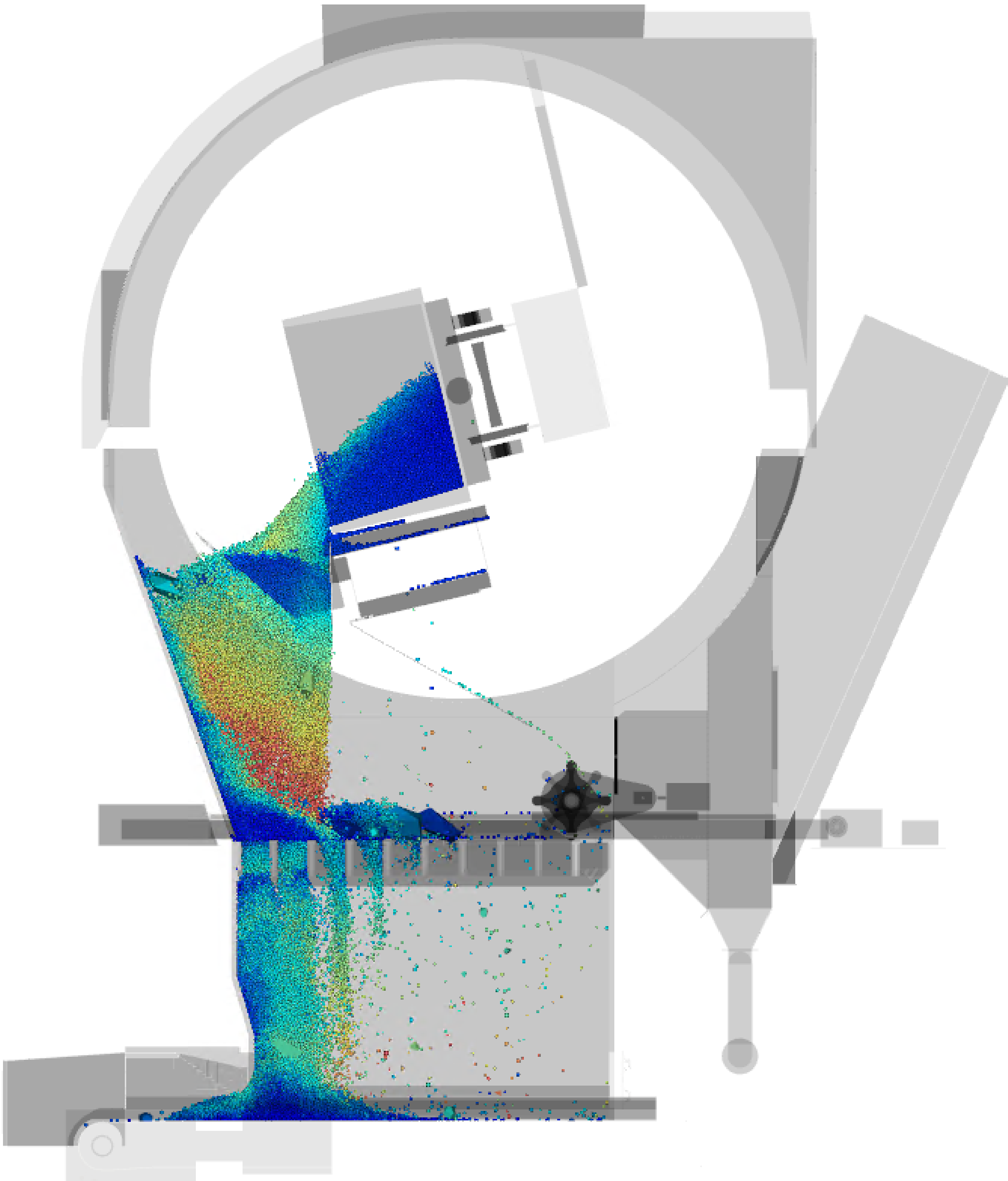
Hatch, a global engineering and development consultant, needed to optimize integrated equipment and processes for its client, Iron Ore Company of Canada (IOC). To solve flow problems associated with adverse weather conditions and frozen, lumpy material, engineers analyzed the rail tippler operation, hopper loading, and low profile feeder (LPF).

IOC site photos of rail cars traveling through snow fields and stockpiles covered in snow

Rail tipplers can experience many types of problems with iron ore flow. Material can freeze during transport and storage. In adverse conditions, such as very cold (-40 degrees to -15 degrees Celsius; -40 to 5 degrees Fahrenheit) weather in Canada, the top surface of the tippler can freeze, resulting in lumps as large as two meters (6.5 feet). These lumps can be difficult to move through equipment, jamming and otherwise affecting flowability, which can result in increased downtime to unblock the system. They can also lead to increased wear and tear on the equipment.

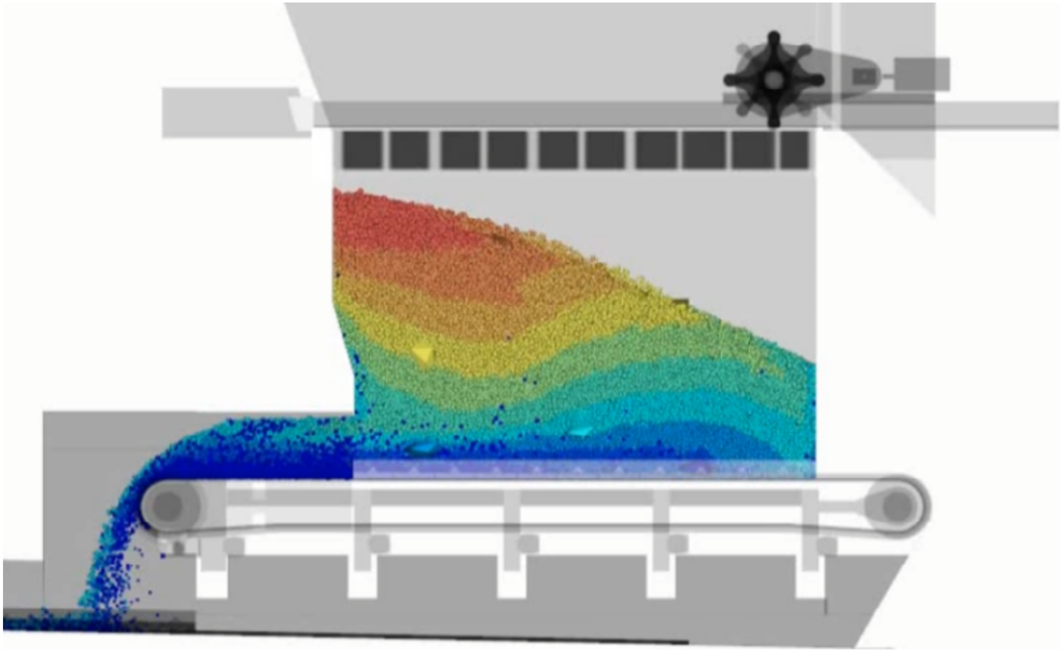
Frozen lump traveling on a belt.

Hatch engineers, led by Luke Stone, who specializes in bulk materials handling, simulated the processing of frozen material moving from railcars into a loading hopper, through a grizzly screen, and into an LPF. By analyzing the hopper loading process, Hatch determined the key flow zones and spillage risks. Optimal liner placement was identified at impact zones, and the cycle times for the lump breaker were ascertained. Level sensors and supporting systems were also located. The simulation provided broad insight into what designers need to look for when equipment integration is completed.



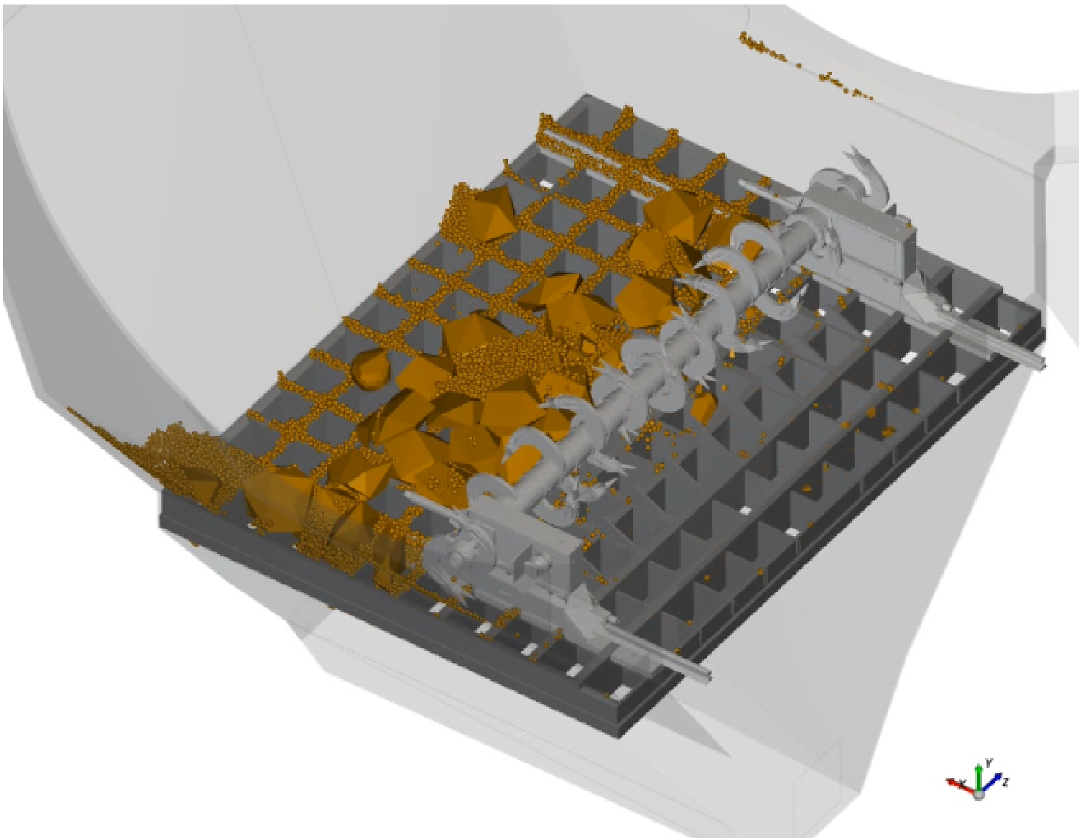
Tippler discharge profile.

For the LPF, engineers used Rocky DEM to analyze the load zone, examining how material presented onto the belt and how the material interacted with skirts. Jamming risks under various conditions were identified. The drawdown profile of the hopper and its interaction with the rest of the equipment, including the tippler, were also assessed. During the DEM simulation, material was dropped from different heights to quantify the impact energy, and the results were verified through physical testing by dropping a 7.5-kilogram lump of frozen concrete.



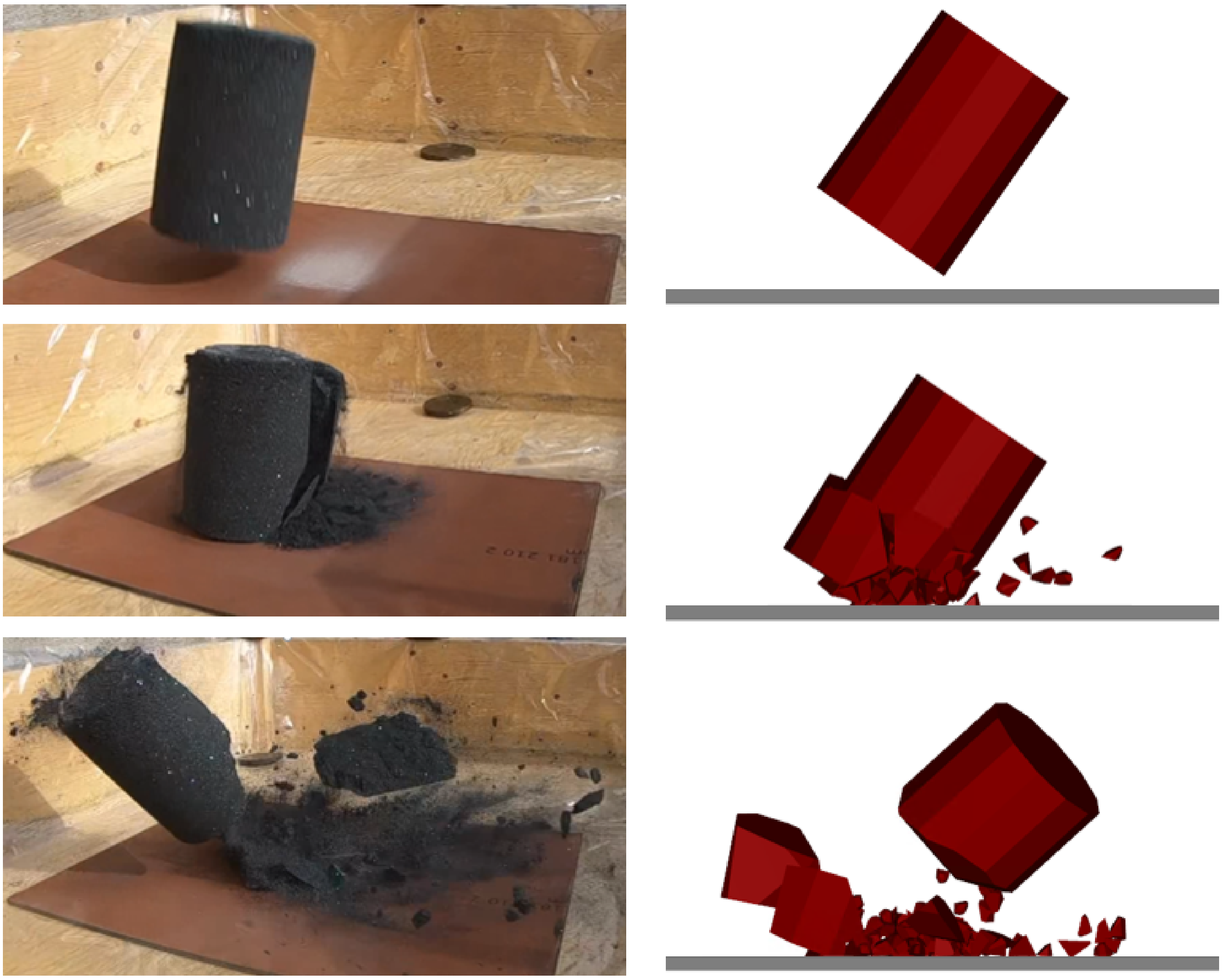
Feeder trajectory and drawdown profile.

Rocky's breakage model showed how little the frozen material lumps break up during the process. The lumps experience a cushioning effect during the discharge and flow, and when they impact on the front wall. The blinding rate increased with each dump cycle, with the grizzly becoming so jammed that the lump breaker required activation within 10 dumps.



Lump breaker translating across the grizzly screen to break up the frozen lumps.

With Rocky DEM, Hatch provided IOC with an in-depth understanding of the behavior of bulk material as it is dumped from the railcar, specifically the impact zones of frozen lumps in the hopper, the material drawdown characteristics in the hopper, and the blinding rate of the grizzly screen due to the frozen lumps.



Conversion of breakage from the laboratory to DEM “digital twin”.

With these insights, the lump-breaking mechanism can be designed and optimized to work more efficiently, boosting iron ore flow, reducing blockages, and accelerating the unloading process.

## Problem

Hatch's client IOC was facing iron ore flow problems associated with adverse weather conditions and frozen, lumpy material in rail tipplers, resulting in downtime and possible wear and tear on the equipment.

## Solution

Hatch engineers applied Rocky's breakage model as an engineering solution to simulate the loading process and discover how lump breakage was occurring, and how to break them up for the material to pass through during the tippler operation.

## Benefits

By analyzing the process, Rocky DEM's simulations helped provide key insights for engineers to optimize IOC's lump-breaking mechanism, allowing for design updates to reduce blockages and equipment downtime.

*Project delivered with support from:*
*Hatch's bulk materials handling team: Liam Andrews, Colin Barbeau*
*Iron Ore Canada, client team: Amaury LeBoyer, Valery Brochu-Levesque, Denis Cote, Stephane Parisee and Roger Langelier.*



**www.rocky-dem.com**

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