BOMAG MARINI LATIN AMERICA

ROCKY

BOMAG uses Rocky DEM to analyze particulate behavior in their asphalt plant equipment

Titanium 140 Asphalt Plant

Images Courtesy of BMLA

BOMAG MARINI LATIN AMERICA (BMLA) is the world market leader in Compaction Technology and manufactures equipment for the compaction of soil, asphalt and refuse, and sanitary landfill. They wanted to improve the efficiency of the two main components that make up their Titanium 140 Asphalt Plant: the counter flow drying drum and the Multi Paddle Pug Mill mixer. To accomplish this, they needed a way not only to analyze the behavior of the material inside the equipment, but to test out potential solutions in a quick and cost-effective manner.

> "The simulations of particles in the asphalt plant mixer using ROCKY platform provided us with an increase of 60% in the mixture residence time, directly impacting the final product and guaranteeing quality for our customers."
>
> Elton Antonello
> *Engineering Manager at BOMAG MARINI*

Reproducing the particle behavior inside the equipment using Discrete Element Method (DEM) software was the solution BMLA chose, but they needed a DEM tool that could handle the unique characteristics of their asphalt material. Throughout each component of the equipment, the DEM tool needed to be able to process a high mass flow rate of many tiny, uniquely shaped particles. In the mixing portion specifically, the DEM tool also needed to accurately represent the real-life "stickiness" and physical combination of the particles after a petroleum-based binding material is injected.

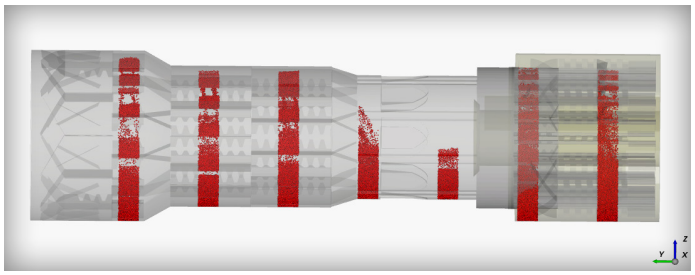
BOMAG MARINI discovered that their simulation requirements could be solved with the unique capabilities found within Rocky DEM software. In the first half of the study, Rocky was used to evaluate the particulate behavior along the drying section of their equipment. Rocky's non-spherical particle abilities were used to create an 8-corner polyhedral particle set for the simulations. This unique particle shape was more representative of the real-life material than the spheres or sphere clumps typically found in other DEM tools.

Eight-corner polyhedral particles were used in the simulations

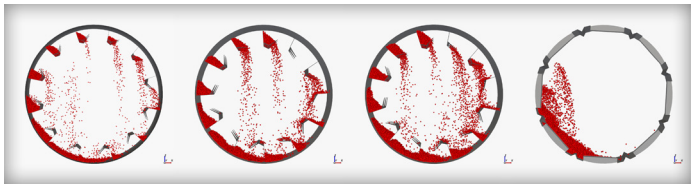
Then, Rocky's GPU processing capabilities were used to simulate the high mass flow rate they needed with substantially reduced computational impact when compared with CPU processing. The GPU capabilities found within Rocky were critical for enabling them to maintain a high particle count while still keeping the simulation times reasonable.

SIMULATION RESULTS

The simulation results Rocky provided made it possible to assess the particle behavior in various cross-sections of the equipment, making it easy to compare the results with field observations in a qualitative fashion.



Side view of the equipment

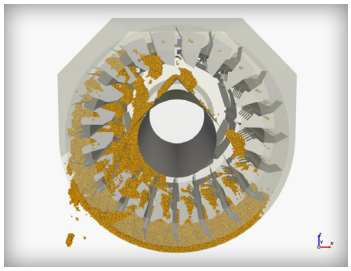


Particle behavior in the first four planes of analysis shown on top (from left to right)

In the second half of the analysis, the focus was the mixing section of the equipment. In this section, a binding material is injected, which is composed of asphalt cement (AC) and fine particles and then mixing fins are used to combine the binding with the particulates. The goal of this second study was to assess the impact of new configurations of fins compared to the original one.

For this second study to succeed, the simulation needed to consider how the asphalt cement adhered to particles, as well as the influence of fines on the cohesion between the particles and the adhesion of the particles to the walls. This was achieved by using Rocky's cohesion/adhesion models to calibrate the particles so that the influence of both the asphalt cement cover and the fine particles were reproduced.

Rocky was able to accurately reproduce the formation of particle clusters due to the cohesive behavior, as well as the adhesion of particles to the walls.



View of the original mixing zone. Formation of clusters due to cohesive behavior of particles can be observed, as well as adhesion to the walls

Using the original simulation results as a guide, BMLA proposed modifications to the fins, which were then simulated in Rocky and compared to the original. The results showed that the redesigned fins improved the residence time in the mixing zone, that is, the mean time the particles spend in this zone. The table below shows these results in percentages, which are higher for Design 2:

Design	Increasing mixer time(%)
1	*
2	100% compared to first design
3	65% compared to first design

Table - Increasing Residence time for original configuration (1) and two proposed modifications (2 and 3)

Rocky DEM software, then, proved to be a useful tool for reproducing the particulate behavior inside the Titanium mixer, as well as for testing new geometric configurations and its impact on the residence time of particles in the system, a key parameter for the process.

CHALLENGE

Getting to know the material behavior inside an Asphalt Plant is very useful, as well as testing different designs, since this knowledge can guide decisions on equipment modifications and help increase productivity. However, those analyses are not possible without a powerful simulation tool.

SOLUTION

Discrete Element Method (DEM) analyses using Rocky DEM software allowed a better understanding of the behavior of the particulate material in this Asphalt Plant equipment. Rocky's qualitative and quantitative post-processing tools led to a detailed evaluation of the particulate flux considering different designs of the equipment.

BENEFITS

Simulations considering different designs for the fins in the mixing zone of the Multi Paddle Pug Mill mixer were carried out. The results enabled an evaluation of the residence time of the particles in the equipment, a key parameter for the process.

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BOMAG MARINI LATIN AMERICA is a manufacturer of compaction equipment for soil, and refuse, sanitary landfill, and asphalt plants. This includes all paving solutions, the quality of which are guaranteed by the FAYAT GROUP.

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