

ROCK RIPPER: BENEFICIAL ACTIONS AND LIMITATIONS

Purpose(s): To obtain better understanding of the efficiency of a rock ripper

Client: THALES GeoSolutions (Belgium)

Date: 2000

Location: Belgium

Partners: None

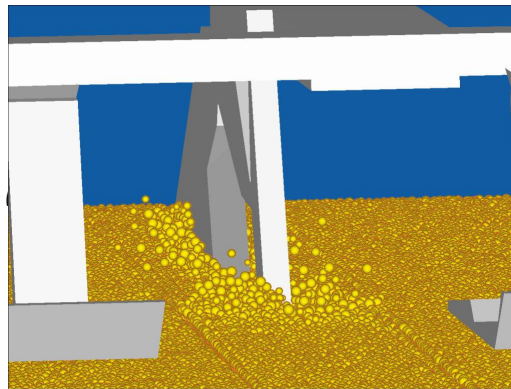
Project executive manager: Fabian DEDECKER

Code(s) used: PFC^{3D}

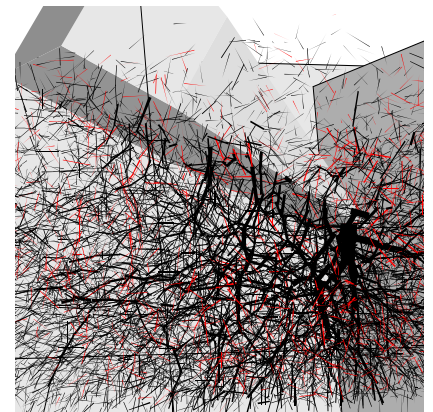
In order to obtain better understanding of **the efficiency of a rock ripper** added at the front of a telecommunications cable machine, ITASCA built a **3D discrete numerical model**, using PFC^{3D}, to model the interaction between a rock ripper and the ocean bottom.

The first part of this study was to **model the plough** as well as **the movement** of each moving element during its installation in the rock mass. The second step was to **model the mechanical behavior** of submarine rock met in situ. **Three rock types, from soft to very hard**, then were modeled to study the penetration of the blade with regard to the mechanical properties of the rock.

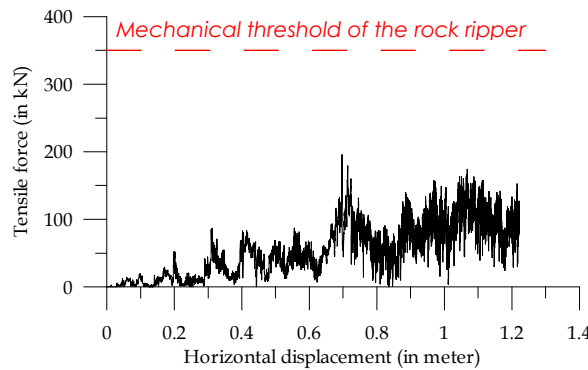
The simulations allowed us to analyze the **penetration of the tip blade** into the rock and to **measure the stresses applied on the blade** all along the simulation with respect to its rock mass cohesion and fracture density (or RQD value).



Model of plough built with PFC^{3D}



Visualization of contact forces (traction in red, compression in black)



Tensile force versus horizontal displacement

KEYWORDS:

- Discrete modeling
- Submarine plough
- Rock ripper
- Rock Quality Desianation

⇒ **RESULTS:**

- The cohesion and initial fracture density of the rock (RQD value) change the penetration of the pre-fracturing blade to a great degree.
- The hardest rock can lead to the crack of the pre-fracturing blade.
- Therefore, the numerical model developed results in recommendations on the penetration angle and speed of the pre-fracturing blade with regard to the mechanical properties of the rock (cohesion, RQD value).