CASE STUDY

USING TIMINING TANGRAM'S AUTOMATED DETECTION FEATURE TO IMPROVE SAFETY AND OPERATIONAL CONTINUITY

Mine:
Minera Escondida

Owners:
BHP, Río Tinto PLC, Jeco Corporation and Jeco 2 Corporation

Location:
Antofagasta Region, Chile

Producción:
1,243 kton of **COPPER** (2018)

OVERVIEW

Minera Escondida is the highest producing copper mine in the world. In its two open pits the fall of unplanned structurally controlled instabilities is one of the primary risks and a factor that affects the operational continuity. When unstable blocks fall, the mine is forced to shut down its operations in order to remove the fallen blocks, which on occasion can lead to operational losses and pose a risk to human safety and equipment. These unplanned events affect the company's ability to comply with its mining plan and this undermines the reliability of the proposed plan.

Minera Escondida's geotechnical team has put into place exhaustive processes to analyze and detect instabilities on planned and built slopes in order to increase the predictability of these events and make mining plan development and execution more reliable.

The unstable blocks are identified with TIMining Tangram software and are recommended to be removed, decreasing the possibility of unplanned blocks falling. With this, the geotechnical team increases the operation's safety and the compliance of the short-term plan designs. The main results of this process are:

- Identify early on close to 40% of all the blocks that were formed based on the density mapping in the current work zones.
- Identify 4 unstable blocks on average each month.

IDENTIFY 4 UNSTABLE BLOCKS ON AVERAGE EACH MONTH

INCREASE IN RELIABILITY OF MINING PLANS

INCREASE IN OPERATIONAL CONTINUITY

40%

EARLY IDENTIFICATION OF 40% OF THE UNSTABLE BLOCKS

"Since adding this tool to our processes, we have been able to reduce the risk of not complying with our short-term mining plan. By decreasing the number of geotechnical events, we have increased our operational continuity and plan reliability."

- Cristian Roa, Senior Geotechnical Engineer at Minera Escondida.

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METHODOLOGY

Minera Escondida's geotechnical team has put into place exhaustive processes to analyze and detect instabilities on planned and built slopes in order to increase the predictability of these events and make mining plan development and execution more reliable.

The team turned to the TIMining Tangram software to support these processes. Tangram is a tool that allows companies to use geolocation to detect instabilities in advance and automatically by mapping structures at the mine site and on planned and built slopes. The Minera Escondida team is now able to identify and predict when instabilities are forming on its short-term plan designs. The problem is solved by employing the methodology described below:

1. All intermediate and major faults historically mapped on site are uploaded,
2. The mapped faults are then projected onto the lower benches of the slopes included in the short-term plan design.
3. The software automatically detects instabilities present on design slopes and identifies which areas have a high potential for forming removable blocks in the short term.
4. A Safety Factor and Failure Probability are calculated for each block detected by TIMining Tangram

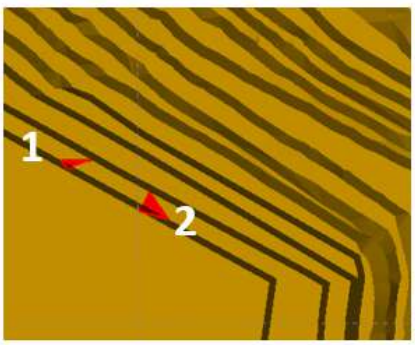
The recommendation is to remove all blocks with a Safety Factor equal to or less than 1.5 and/or a Failure Probability greater than 20% once the bench in question has been mined with a shovel. This will lessen the possibility of having blocks fall out of schedule and improve operational safety and compliance with the short-term plan.

RESULTS

The following is a description of a few of the results obtained:

Topographic Surface of Design N°1

1. Plane Fault (0.2 Kton), Safety Factor (0.98) and Failure Probability (24%)
2. Plane Fault (1.7 Kton), Safety Factor (0.75) and Failure Probability (83%)



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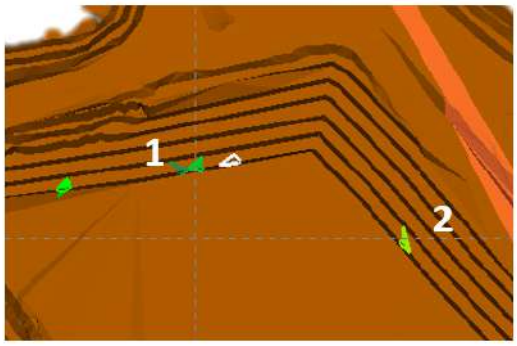
Topographic Surface of Design N°2

1. Plane Fault (1.1 Kton), Safety Factor (0.45) and Failure Probability (99%)
2. Plane Fault (1.7 Kton), Safety Factor (0.83) and Failure Probability (74%)



IMPACT

By identifying and predicting the formation of instabilities in short-term plan designs, the geotechnical team was able to:

- Identify early on close to 40% of all the blocks that were formed based on the density mapping in the current work zones.
- Identify 6 unstable blocks in the November 2019 plan and 4 unstable blocks on average each month.
- Include in the monthly planning the operational tasks required to control and manage on-site geotechnical risks faced by mine operations personnel.
- Recommend that operational personnel use shovels or other mechanized equipment to unload the blocks immediately after mining the benches. This makes for a more dynamic expansion of the mining process because you can prevent operational shutdowns, make strategic decisions that don't have an impact on production, and ensure the operational continuity of the mining plan.
- Geotechnically, the process has provided the team with greater visibility for its risk management activities and to benefit in the short-term from the analysis efforts.