

## CASE STUDY: Short Interval Control Monitoring Improves Mine Planning in Large-Scale Open-Pit Operation

### EXECUTIVE SUMMARY

TIMining and a large-scale open-pit mining operation worked together for 60 consecutive weeks to identify the level of correlation between the short interval control (SIC) methodology, a monitoring digital twin technology, and a process indicator.

The results were evaluated and compared in terms of compliance with the mine plan, considering the use of the TIMining Aware technology for monitoring SIC of operational activities.

With the implementation of SIC and the support of TIMining Aware technology, a pathway to more accurate and efficient planning was enabled, facilitating informed and real-time decision-making. This combination offers a comprehensive and advanced approach for the mining industry, significantly improving operational management and achieving mine plan objectives.

### Introduction

The mining industry faces significant challenges in short-term planning to ensure the quantity and quality of materials required for downstream processes. Specifically in open-pit mining, operational processes are supported by various technologies, sensors, systems, equipment, and personnel, which can lead to silos that hinder a comprehensive view of parameter changes and coordination in decision-making due to the level of information managed by each actor.

The purpose of this case study is to demonstrate the potential for improving compliance with the mine plan through the incorporation of technologies and new monitoring practices in daily operations. This would streamline the process of analyzing deviations and process alerts, facilitating decision-making supported by reliable and accessible information.

In this study, different cases of operational practices that could be improved have been evaluated. These include:

- Proper positioning of hauling and loading equipment
- Adherence to planned speeds on transport routes
- Transfers of loading equipment from areas not fully completed
- Human coordination challenges in the new reality of hybrid work post-pandemic

These areas show a high potential for improvement, which could critically impact the common objective of fulfilling the mine plan.

## Short Interval Control and the TIMining Aware Technology

IC has proven to be an effective tool for improving mine planning by providing access to real-time information on equipment performance and availability. This enables more frequent feedback on the mine plan, leading to more efficient planning.

However, to enable real-time data-driven decision-making, it is crucial to have components that provide a holistic view of the process and timely access to critical variables. In response to this need, the TIMining Aware technology was developed, which integrates various relevant sources of information into a user-friendly platform. This technology uses advanced analytics algorithms specifically designed with mining logic and offers a friendly visualization to identify deviations and bottlenecks. Moreover, it provides real-time information available to all relevant stakeholders in the decision-making process.



Figure 1: Snippet of the TIMining Aware technology dashboard.

## Outcomes and Impact on the Team

The study conducted revealed significant results regarding the use of the TIMining Aware, a solution based in a digital twin technology, for monitoring loading and hauling operations.

The target teams for this study were the planning and operations departments. On average, 5.3 individuals connected daily to the digital twin, responsible for verifying whether the activities performed were in line with the planned conditions or if there were deviations due to operational reasons or decisions made without the necessary information to improve overall performance.

During the weeks in which the TIMining Aware technology was used to monitor compliance with the mine plan, there were increases of over 15% in improvement, with the average value achieved in the monitored weeks reaching 68%.

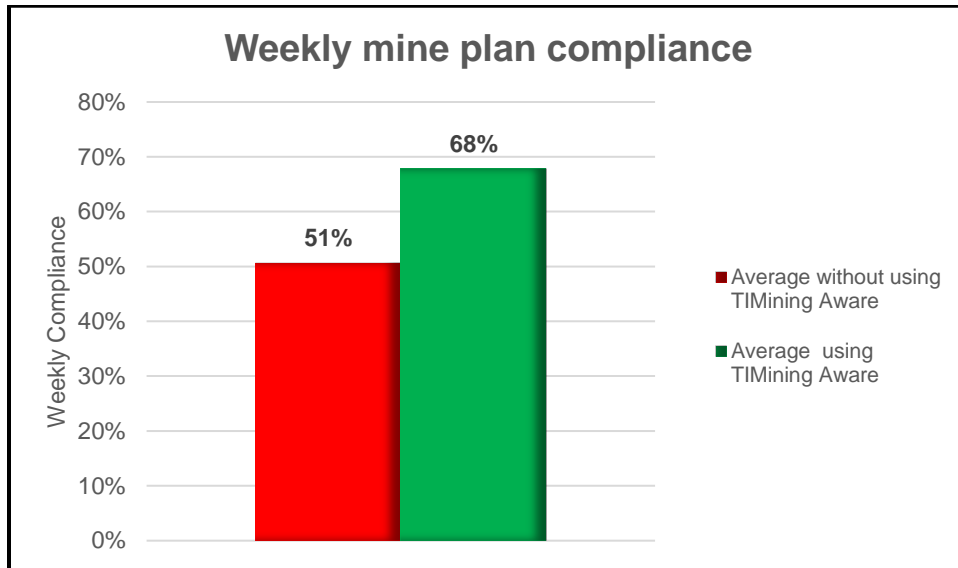


Figure 2. Graph showing the weekly mine plan compliance comparison with and without the technology.

These results indicate that the effective implementation of TIMining Aware in the monitoring process positively impacts the compliance with the mine plan. When the technology is appropriately used, there is a higher degree of alignment between operational activities and planned conditions, resulting in a significant increase in meeting weekly objectives.

These findings highlight the importance of adopting advanced technologies and monitoring practices in the mining industry to achieve greater efficiency and enhance overall operational performance. They also highlight the relevance of an organizational culture that supports the implementation of these tools and motivates teams to use them effectively.

### Key Findings and Lessons Learned

The study revealed a significant correlation between the monitoring frequency, using SIC through the digital twin solution, and the percentage of compliance with the theoretical weekly progress compared to the planned targets.

It is important to highlight that fulfilling the mine plan is a complex and multifactorial process subject to various variables including but not limited to:

- Weather conditions
- Asset availability
- Workforce
- Geotechnical factors

There is always a possibility of unexpected events that can impact execution of the plan as originally defined. However, by rigorously monitoring a set of critical operational activities, timely decisions can

be made to minimize the time spent operating under suboptimal scenarios and quickly correct any deviations to return to the optimal path.

Within the activities evaluated in the study, some were found to be particularly relevant to the compliance with the mine plan, including but not limited to:

- Ensuring the proper positioning of hauling equipment.
- Completing the extraction of planned polygons before equipment transfers.
- Adhering to the planned speeds on transportation routes for the truck fleet.
- Managing waiting times and queues for trucks.

In addition to quantitative aspects, a qualitative parameter was also considered in the study, which is the timely access to reliable information for each area involved in tactical and operational decision-making. Having access to reliable and up-to-date information, supported by technology, enables informed decision-making when facing unforeseen events or deviations from key indicators for meeting the schedule.

In summary, the implementation of the SIC methodology using the digital twin solution enabled:

- A higher compliance with the mine plan by facilitating timely decision-making.
- Rapid correction of deviations.
- The ability to provide reliable information for more effective and efficient management of mining operations.

## Collaboration as a Success Factor for Implementing New Technologies

The incorporation of new practices into the work teams is a fundamental factor for the success of any methodology and technology implemented in the mining industry. This requires a cultural transformation that motivates and aligns people towards common goals.

It is essential for an organization to modify its culture and adopt new measurement methods based on clear objectives and focused on continuous improvement, rather than solely on penalties. This fosters an environment where people feel motivated to actively participate in the process of change and improvement without fear of reprisals.

Furthermore, fostering a collaborative culture among mining companies and suppliers is crucial. Working together and defining joint strategies will maximize the value of the business and pave the way towards a more productive, safer, and environmentally responsible mining industry.

Collaboration among different stakeholders in the mining industry will not only strengthen the implementation of innovative technologies and methodologies but will also address common challenges and find more efficient and sustainable solutions for the industry.

## What is next for the industry?

To achieve excellence in the mining industry (i.e., make the industry more efficient, safe, and environmentally responsible), mining companies must be willing to challenge their paradigms and adopt best practices from other industries. The current level of technological maturity enables new ways of

working, providing a deeper understanding of processes, historical data analysis, and the ability to anticipate future events.

Incorporating control methodologies, such as SIC and the use of digital twins solutions, allows for the visualization of new opportunities and challenges. However, to effectively implement these practices, organizations must engage and lead the necessary cultural transformation from various levels.

Undoubtedly, there is room for improvement in both the compliance process of the mine plan and overall mining operations. But achieving this requires managing change within organizations. It involves adapting processes to new realities, providing the right incentives to people, and ensuring that technology adds the expected value to the business.

The key lies in collaboration among different stakeholders in the industry, promoting a culture that fosters innovation and continuous learning. The adoption of new technologies and efficient practices must be supported by an open-minded approach to change and a long-term vision that prioritizes sustainability and environmental care.

By driving cultural and technological transformation in the mining industry, it will be possible to move towards a more competitive and responsible mining sector. Through the joint effort of organizations, individuals, and technology, excellence can be achieved in the mining industry, ensuring sustainable development and benefits for society.

### **About the Asset Management Working Group**

The GMG Asset Management working group is an inclusive and global operator-driven community of interest whose primary purpose is to identify and share leading practices in asset management, reliability, and maintenance. The group is dedicated to developing asset management guidelines that result in improved safety, ESG, and operating performance for the benefit of the mining industry.

### **About the Data and Interoperability Working Group**

This groups aims to address challenges that the industry faces related to data management, interoperability, and integration through work that supports and enables common language, data quality, data exchange, data sharing, and data access.

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### **About GMG**

The Global Mining Guidelines Group (GMG) is a network of representatives from mining companies, original equipment manufacturers (OEMs), original technology manufacturers (OTMs), research organizations, academia, regulatory agencies, consultancies, and industry associations who collaborate to tackle the challenges facing our industry. GMG aims to accelerate the improvement of mining performance, safety, and sustainability by creating guidelines and white papers that address common industry challenges, facilitating collaboration and expanding the industry's knowledge base. GMG also hosts and supports events that bring mining stakeholders together along with external industries to address the industry's challenges, successes, and innovations. Learn more about GMG at <https://gmgroup.org/>