

Tropicana Gold Mine Optimisation Project



Design brief Increase throughput from 6.5 Mtpa at 90% availability to 7.6 Mtpa at >95% availability.
Delivered 7.6 Mtpa throughput at >95% availability.

It is a pleasure to report on the successful outcomes of a collaboration between Tropicana Gold Mine and Mintrex to optimise and increase the throughput of Tropicana process plant without changing major equipment. A number of opportunities had been identified by AngloGold Ashanti as part of their Operational Excellence continuous improvement work which formed the basis of the project scope.

Mintrex was engaged to prioritise, define and cost the maintenance and processing options at scoping level ahead of design and implementation.

The optimisation project delivered multiple benefits to the Tropicana Gold Mine, some of which had immediate results and others with a long-term benefit, which have become apparent over several months since completion of the process.

Process Benefits

The debottlenecking process of the conveyors, bins and feeder restrictions and the construction of two additional leaching tanks provided immediate benefit by allowing an increase of the plant throughput whilst maintaining expected recovery.

The process plant achieved the design intent to increase in throughput from 6.5 Mtpa to 7.6 Mtpa. The Tropicana Gold Mine subsequently added milling capacity to increase throughput to 8 Mtpa with no further upgrades required on conveyors or bins.

Maintenance / Shutdown Benefits

The several benefits of the optimisation project extended to plant maintenance by reducing liner replacement time and wear. The time to replace the wet screen bin liners halved to 24 hours due to the redesign of the lining system. This was coupled with significant wear reduction leading to an extension in liner life from 17 weeks to more than 2 years for the HPGR feed bin, driven primarily by the redesign of the bin discharge geometry. The result was a reduction in shutdown duration and an increase in plant utilisation which, combined with the optimisation of other equipment, increased the overall plant utilisation to >95% from 90%, with significant associated cost savings.



Figure 1: Construction of two additional leaching tanks

Safety Benefits

The implementation of safety sub-projects during the optimisation project provided immediate safety improvement for various plant areas. Safer access to chutes and bins reduced the potential for personnel injury and scaffold requirement for plant maintenance.

A great improvement was the reduction of hydrogen cyanide gas around specific areas of the plant, also providing a safer working environment.

Optimisation

Conveyor Optimisation

Some conveyor problems that were occurring at Tropicana are listed below with the recommended modifications/upgrades that were delivered:



Figure 2: An optimised conveyor at the Tropicana Gold Mine

Unexpected material behaviour (such as ore rolling back on conveyor):

- Replacement of installed soft starters and fluid couplings with VVVF drives to extend the starting time;
- Installation of new gamma scale to monitor and control material sliding; and
- Reduction of take-up counter weight and conversion of pulley drive to ceramic lagging.

Ineffective feed control strategy:

- Review and adjustment of the equipment settings around the conveyors to reduce recirculation load. The successful outcome from this strategy meant there was no longer a need to consider upgrading the conveyor.

Overloading due to increased throughput:

- Review and adjustment of the existing control strategy to prevent overloading onto the conveyors.

Other problems such as belt tracking and splice failure issues which were not related to the mechanical design of conveyors:

- Advice and support to the maintenance team.

Other upgrade recommendations, which were used for future duty requirements (increase of plant capacity), in addition to the recommendations above were:

- Upgrade of the conveyor drives with bigger motors;
- Increasing the conveyor belt speed; and
- Changing the conveyor drive from soft starter / fluid coupling to VVVF. This change alone has improved the plant operations significantly. The improvements are as follows:
 - Conveyors are now being controlled better, so the start-up is smoother; and
 - Before the upgrade, following a crash stop of the conveyor, the conveyor often could not be restarted. Following the upgrade, the conveyor could be restarted at full load torque at a slower speed.

Pulping Box Optimisation

The wear rate of the original pulping box was excessive, leading to inadequate liner life and the need to have the liners changed out every shutdown (12 week intervals and 48 hours duration). This work was labour intensive and required a complete clean out of the bin before any maintenance could be performed.

The key objectives for the pulping box optimisation were:

- Design for liner maintenance to be completed in less than 24 hours;
- Design for 12 months service between maintenance intervals;
- Improving pulping of the material; and
- Redesign to a rotatable unit for ease of lift-out and replacement.

Optimisation Result

The newly designed pulping box has lasted more than 18 months with minimal maintenance requirements during shutdowns. Redesign of the water injection and arrangement of the flow into the box has improved pulping and drastically reduced the wear rate of the equipment. A new rotatable unit is in store with a replacement schedule implemented within the overall site shutdown strategy, taking less than 24 hours to change over.



Figure 3: Ceramic lined pulping box

Dry Screen Bin and HPGR Wet Screen Bin Liner Optimisation

Liner change in these bins during a shutdown was time-consuming as access was restricted to winching by a rope or via scaffolding. Furthermore, the bins under review had small individual liners resulting in a larger quantity needing replacement.



Figure 4: Modular one-piece drop in liner

The key objectives for this redesign were:

- Liner redesign to allow replacement to be completed in less than 24 hours; and
- Liner redesign for 12 months service between maintenance intervals.

Replacement of numerous small liner plates was a tedious task and in many cases was on the critical path for plant shutdowns. In consultation with the plant team, a large modular “one-piece drop-in” design liner was selected, for both bins, eliminating the need to change multiple small liner plates and thereby reducing servicing durations. The liners were replaced onsite utilising a 90 t slewing crane with some modifications to the top of bin structure.

Optimisation Result

It took 2 shifts of 12 hours each to modify and install the large liner. The upgraded liners have achieved a wear life in excess of 24 months and it will be possible to achieve the future liner replacement in less than 24 hours.



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