

Paste Supplement

risk and not as forgiving as gravity distribution. At 340 t/h (185 m³/h), the Tahoe system is one of the largest backfill plants in the Americas, requiring the largest paste (concrete) pumps available on the market to meet throughput and high pressure to cover 2 km strike and reaching 200 m above the paste plant.

Kovit's review identified critical plant design issues, relying on its extensive experience with identical systems. This type of modular plant can be effective for continuous free-flowing sand, classified tailings or aggregate, but was definitely incompatible for this operation.

Incomplete mixing and inability to control rheology and strength have dramatic and potential fatal flaws for most operations. Coupled with a tailings dewatering method and variable feed rates, the plant was not geared to any of the main challenges. Bins and feeders could not handle the incoming feed rate, while a grenade explosion-like noise coming from the mixer was in large packed clay-like clumps of pressure filter cake ponding the inside. Clumps and muddy water into the paste pump hopper could not be termed an "engineered fill."

Subtle rheological control of $\pm 0.5\%$ moisture is challenging in complex large batch plants so is impossible within small continuous mixers found in the constrained sea container. Even slight variations in moisture can readily double pipe friction losses, potentially arresting

pumping and resulting in 2 km of blocked pipeline and lost production. On the other hand, slight increases in moisture from 175 to 250 mm slump diminishes strength by up to 30%.

Additional design challenges of the modular plant included:

- Non-sequenced discharge of 30 t batches from each of four pressure filters resulting in large peak surges and zero flows creating havoc for feed regulation to the mixer
- Main 850 m conveyor belt resulted in overload stoppages and difficult restart with surges
- Lack of feed buffer created highly variable mixer residence time
- Surges in flow into exceedingly small paste hopper was ineffective for smooth control of paste pump speed

Kovit initially focused on low cost solutions with minimal shut-down impact to resolve the above issues. The small compartmentalised containers and inadequate seismic consideration in the structural design precluded modifications.

A fast-track concept-to-erection was completed in 12 months. This was achieved even though a bold and innovative approach was needed due to existing infrastructure and topography, with inability to excavate deeper. Fitting into the main conveyor required fitting a 2.5 m reduction in height from a typical batch

plant. Stuck between a rock and a hard place, a radical and innovative design ensued:

- large pressure filter cake receiving bin to smoothen feed rate, required 2.5 m more height
- integrated filter cake disintegration/feed system
- innovative proprietary continuous-to-batch paste preparation technology, with 10 m³ mixing (compared to modular plant with <2 m³) while reducing plant height by 2.5 m
- Novel 20 m³ paste pump hopper (compared to <1.5 m³), reducing plant height by 1.5 m
- Innovative proprietary binder batch system improving engineered paste mix
- Robust design with two mixers and feeder with 450 kW versus the original single 75 kW mixer.

Commissioning required two weeks for the new customised plant, and has since continued to effectively meet the customer's needs. Final scope for Kovit included the design/supply of the plant and detailed design of the UDS.

Kovit Engineering Ltd is now part of Materials Management within Outotec (Canada) Ltd, bringing together the most significant global experience from Canada, Australia and Sweden, specialising in backfill, tailings management and water treatment solutions. IM

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Meeting backfill and tailings capacity

Miguel Jahncke, Director Global Mining and Director Latin America at Schwing Bioset outlines two case studies from Mexico and Peru where the company's pump solutions met backfill and thickened tailings challenges



New and improved paste plant at San Jose mine with Schwing Bioset KSP80 pumps

Fortuna Silver – San Jose

The San Jose mine, one of the flagship operations of Fortuna Silver Mines, located in the state of Oaxaca in Mexico, was commissioned in July 2011 and began commercial production in September 2011 at a rate of 1,000 t/d. In September of 2013, the mill was expanded from 1,150 t/d to 1,800 t/d and in April 2014, the mill was further expanded to 2,000 t/d. Expansion of the mill from 2,000 t/d to 3,000 t/d was initiated in the first quarter of 2015 with commissioning planned for July 2016.

During the initial installation, the operation received two Schwing Bioset KSP80 pumps, one for operation and one for stand-by. As the reserves increased and the mine production and processing plant expanded, San Jose evaluated different options for handling the additional mine backfill requirement, finally deciding upon the reconfiguration of the KSP80 pumps and their installation at the new and improved Paste Plant, in a parallel arrangement. This new arrangement allows San Jose to handle double their initial paste flow capacity with no additional investment in larger pumps.

In addition to the parallel arrangement, Schwing Bioset also upgraded the control panel with its patented multi-pump synchronisation system. This system allows both pumps to continuously “talk” and make adjustments to their stroke timing while pumping, ensuring

that, regardless of the pump speed, continuous flow through the pipeline is achieved, mitigating the potentially negative effects of water hammer.

The new system was recently commissioned and now operates as a single 4-cylinder pump with no need for additional pipeline pressure dampening to maintain smooth pumping operations, as would be expected from multiple independent pumps feeding a common pipeline. The configuration also allows for the units to be decoupled for maintenance or when plant tailings delivery is reduced, continuing operation with two cylinders to maintain the single pump flow capacity.

Further proving their versatility and toughness, the Schwing Bioset pumps were the only components that were saved from the old paste plant to be reutilised in the new paste plant. Upon completion of the 3,000 t/d expansion, the mine will produce 9-10 Moz/y of silver and 52,000-53,000 oz/y of gold, ranking the San Jose Mine among the world's top-13 primary silver producing mines.

Volcan Compania Minera – Victoria

In late 2012, Volcan Compania Minera SAA's Victoria zinc-lead-silver mineral processing plant, located in the Yauli district, in the department of Junin in Peru, was facing a number of challenges including the approval of their Environmental Impact Statement for a capacity expansion from 2,400 to 4,000 t/d of ore.

The project also required the expansion of the Rumichaca tailings site to accommodate the increased production levels. Pumping thickened tailings, rather than conventional tailings, was determined to be the best long-term and financial solution to handle the mining rejects. The project continued to evolve in that direction.

In mid-2014, when the final solution for the thickened tailings transport was being evaluated, it was determined that the solution offered by Schwing Bioset, with its model KSP440 piston pump, was ideal for the project for the following reasons:

- The KSP 440 unit is capable of the required maximum flow of 185 m³/h as well as reduced flow of 92 m³/h when at low plant production rates, which is expected at certain times by idling a module within the pump.
- Half of the pump can be idled while half continues to operate allowing for preventive maintenance to be performed while operations continue at a slower pace or to accommodate unscheduled downtime
- Elimination of additional and costly stand-by equipment, with the modular pump arrangement
- Drastic reduction of water hammer in the discharge line without the use of Pulsation Dampeners through PLC synchronisation that monitors and adjusts the timing of the pumping strokes.
- Electric motor and hydraulic redundancy in the power pack allowing partial capacity in the event of unscheduled maintenance. **IM**

Schwing Bioset KSP440 piston pumps at Rumichaca tailings site, Peru

