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Nordic Mining Technology — New Techniques Target Safety and Sustainability

*Tailings Management
Conveyor Systems*

Industry 4.0 Solutions Improve Conveyor Performance

New and proven digitization, automation and machine monitoring solutions offer optimal conveyor designs, improved production, and simplified, safer maintenance

By Jesse Morton, Technical Writer

New and established Industry 4.0 solutions feature prominently in the latest news on mining conveyor solutions. While the pace of innovation in the sector is comparable to that of other sectors within the mining equipment space, the number of features and benefits offered by the top digitization, automation, and machine monitoring solutions appear to beat the averages.

Undoubtedly, when these solutions are used, conveyor performance is improved, suppliers say. Further, conveyor design, monitoring, and maintenance tasks are simplified and made safer. The latest headlines from the space show how much so.

Cut Maintenance Time in Half

Martin Engineering reported the N2 Position Indicator (PI) conveyor belt cleaner remote monitoring system is a proven tool that enables mines and processing operations to be safer and more efficient, without a significant capital investment.

"There are more than 1,000 PIs already in service around the world, successfully delivering critical real-time intelligence in the form of actionable data that took days or weeks to compile in the past,"



The N2 Position Indicator unit is made from rugged polyurethane, fits onto the end of the belt cleaner, is battery powered, and uses a license-exempt radio frequency. (Photo: Martin Engineering)

said Mark Slack, global product manager. That data is "now available literally in just seconds," he said. "The devices can currently be found in North and South America, India, Europe, Africa and Asia."

For primary belt cleaners with a polyurethane blade, PI uses sensors to track the condition of each belt cleaner and tells users, via a cloud-based app or a computer dashboard, when servicing is needed.

The system tracks and reports "automatically on the condition and remaining service life of each unit, notifying Martin service technicians and plant operations personnel when re-tensioning or replacement is required or when abnormal conditions occur," Slack said.

Each unit is "a small, robust self-contained donut made from proprietary grade polyurethane that stands up to punishing industrial environments," he said. "The sealed construction means they are virtually immune from damage."

The PI "slots neatly onto the end of the belt cleaner and can fit any size mainframe, whether round or square," he said.

Each PI "is a self-contained system," Slack said. Battery powered, it does "not require an external power source."

The PI can be installed inside or outside the transfer chute. "It's recommended that PIs be mounted anywhere up to 1,000 m from the cellular gateway, but successful connections have been established from as far as 6 km away," Slack said.

"It has also been designed to be reliable in the challenging ambient environment found at operator sites, even those conveying wet or sticky materials," he said.

The system offers several benefits. It offers time savings, streamlines maintenance, and improves workplace safety, Martin Engineering reported.

It saves time on installation, which is "straightforward," Slack said. "A PI

can typically be installed in around 20 minutes, often with the belt running," he said. "Further, the technology can be scaled up quickly, avoiding lengthy downtime or steep learning curves."

The system requires relatively minimal communications infrastructure. "Unlike competing systems, it does not require a cellular link for each PI," he said.

The system uses a license-exempt radio frequency that allows up to 1,000 PIs to be monitored through a single gateway. "Operating independently of any plant communications infrastructure, only the gateway requires a constant 110- to 240-VAC power supply," Slack said.

It also saves time by effectively eliminating "needless inspection visits, reducing the necessity to physically access each belt cleaner unless the system shows that servicing is required or there's a potential problem that needs attention," Slack said. "Managers and service technicians can quickly access info on any networked cleaner via mobile device."

The system further streamlines maintenance by simplifying maintenance planning. "Having detailed information available on demand allows service personnel to deliver and install replacement wear parts during scheduled outages," he said. "By monitoring the rotation of the belt cleaner mainframe, the N2 Position Indicator helps managers plan tensioner adjustments and blade replacements during scheduled outages."

Belt cleaner service can be done during scheduled downtime, with fewer unplanned stoppages.

And, critically, maintenance personnel no longer "need to physically view the cleaner to determine the tension or wear status," he said. That reduces the possibilities for safety incidents, and frees up people to do other work. "Perhaps most important, reducing staff exposure to moving conveyors helps

minimize the risk of accident or injury and the losses that can result, enhancing personal safety while contributing to greater profitability.”

Data from the system can be saved for use as “a maintenance log with service dates and work performed,” Slack said.

Research and development for the system launched roughly a half decade ago. “The engineering team recognized an opportunity to dramatically impact inspection time, data tracking and personnel safety with one revolutionary product,” Slack said.

“Martin Engineering started installing the PI at U.S. test sites in 2020, with global development following in 2021,” he said. “Now operating on five continents, there are more than 1,000 units currently in operation.”

Faster, Reliable Planning Results

BEUMER reported using a holistic approach, supported by “3D-design tools” to successfully design and supply a high-performance solution for a coal operation in the U.S. The initial plan was for a four-conveyor system. “BEUMER was able to design, deliver, install, and commission a 4-mile-long, single-flight conveyor system in less than 14 months,” said Peter Sehl, sales director for North America. “We are using the same process and tools now on multiple pre-feasibility and feasibility level studies where we support engineering consultants and owners in developing the best solutions.”

The approach, design tools and the resulting solutions are effectively the culmination of “more than 60 years with our many curved conveyor references,” he said. BEUMER’s curved overland conveying technology combines multiple straight conveyor segments into a single-flight transport solution, eliminating the need for intermediate transfers and drive stations.

“This technology is not new, but the engineering approach has been improved and uses now-automated tools and processes,” Sehl said. “This leads to more flexibility during the engineering phase and shorter schedules.”

The supplier’s holistic approach in the design phase accounts for environmental constraints like topography, property boundaries or construction cost. That prevents serious setbacks in later phases.



BEUMER used advanced design tools and a holistic approach to design, deliver and install a 4-mile-long, single-flight conveyor system in less than 14 months. (Photo: BEUMER)

“In many projects we see a disconnect between the tasks. The disconnect leads to a sub-optimum conveyor route and layout,” he said. “Once the route of a conveyor system has been defined in an earlier project phase and the project has been permitted, it is difficult, time consuming and sometimes impossible to change it.”

Beyond allowing the supplier to be proactive, the approach, supported by automated design technology, also enables it to be accommodating when unexpected changes to plans are necessary.

“We realize that especially in early project phases, customers are seeking the most efficient and reliable transporting option,” Sehl said. Typically, customers use an iterative process to identify the best transporting solution in terms of total cost of ownership.

“Here, BEUMER’s holistic approach and improved engineering tools enable us to incorporate changes to the conveyor routing, even at short notice, without delays in the planning,” he said. “This is truly ‘end-to-end’ 3D planning, drawing creation and determination of BOM, with all necessary information on earthworks as well as coordinates for installation,” Sehl said. “This leads to faster and the most reliable planning results, ultimately reducing costs and efforts for our customers.”

Benefits also include quick results during trade-off studies. “Our reports include 3D visualizations of the conveyor system in the actual terrain that can be

used for permitting and engagement with local communities,” he said.

The quick results include high-accuracy CAPEX and OPEX estimates, “including cut and fill calculations, even in preliminary project phases,” he said.

Total engineering time during project execution is reduced. After completion, the solution will outperform competing traditional transport systems in many metrics, Sehl said. “Our solutions give an overall reduced total cost of ownership” and improved safety “while also being more sustainable, with reduced power consumption, greenhouse gas emissions and dust.”

BEUMER conveyor solutions have fewer transfer stations, which means less maintenance. “It also means reduced dust, extended belt life, fewer mechanical and electrical components to maintain, and a smaller spare parts inventory,” he said.

BEUMER entered the overland conveyor business in the 1960s. “Since then it has been developing and supplying highly efficient overland conveyors with horizontal and vertical curves, making the company one of the pioneers for this technology in the industry,” Sehl said.

The advantages offered by the BEUMER approach are best actualized if the supplier is brought on early in a project. “That allows us to define the constraints, and allows us to think out of the box,” Sehl said. Out-of-box thinking is imperative to arriving at solutions that help cut costs and attain sustainability



PilePro Automation and the similar heap leach automation system for the TeleStacker Conveyor were designed to be integrated into a parent control system for conveyors. Above, a conveyor system ends with a Telestacker Conveyor at a site in San Felipe, Mexico. (Photo: Superior Industries)

goals. “Sustainability is very important to BEUMER,” he said.

Automatic Optimization of Stockpiles

Superior Industries reported its conveyor automation packages help customers optimize stockpiles and increase efficiency.

The manufacturer offers two solutions for its flagship TeleStacker Conveyor that “control the operation movement functions to optimize the stockpile,” said Travis Thooft, P.E., chief engineer, portable conveyors.

PilePro Automation controls the TeleStacker Conveyor to minimize material segregation in traditional radial stockpiles. For heap leach operations, Superior offers an automation solution “for retreat stacking that creates a level pile top at a constant pile width,” Thooft said.

PilePro Automation can be used “to create either a partially or fully desegregated stockpile,” he said. “It controls the discharge drop height onto the pile

off of the conveyor as well as it controls the speed and location of the discharge point to create basically a series of layered stockpiles that build up into a larger stockpile.”

The system uses two sensors and an advanced algorithm.

“There is a sensor on the discharge point of the telescopic conveyor. It is looking down and watching the material underneath it,” he said. “That is how it determines drop height.”

Drop height is needed so the system can make sure the “structure never actually interferes with the existing material pile,” Thooft said.

The second sensor is “located back underneath the radial axle,” he said. “It is looking for something that would represent the center location on the stockpile so that it doesn’t introduce drift too far one way or the other.” That makes sure the TeleStacker Conveyor is “always piling over the same location and creating the subsequent stockpiles on top of each other.”

The centering sensor is set manually. “But once it is in place, the system does all the rest of the calculations automatically,” he said.

The sensor detecting drop height is preprogrammed at the factory.

The sensors and algorithm “integrate with a PLC on a unit that is doing the thinking,” he said. “The algorithm takes the sensor input and then tells the different functions on the telescopic conveyor what to do to mitigate the segregation in the stockpile.”

The system features a zoning method that makes sure “the pile volume is filled out on the back side of the pile, where more volume is needed to achieve a true desegregated pile,” Thooft said.

“We offer four different standard pile types, allowing the operator to choose the laydown option that works best in their operation,” he said. The interface has simplified controls and a limited set of input screens that help guide the operator on setup.

“The user experience has been improved over time,” he said. The interface “makes it really easy for an operator to follow through and understand what information they are inputting.”

It asks for specific, but minimal, information. “It is not an overwhelming set of questions you have to answer before you start running the machine,” Thooft said.

“The operator can set the radial travel limits or the maximum clockwise or counterclockwise travel length,” he said. “They can program the TeleStacker Conveyor to make sure that it doesn’t run into anything.”

The operator can also key in the extension height increment. “They can set the increment that the conveyor raises in between when it senses materials,” Thooft said.

The interface also offers an advanced troubleshooting screen. “It allows an operator with an understanding of the inputs and outputs to go in and verify that the program is receiving the right inputs and outputting the right outputs,” he said.

If that doesn’t work, Superior engineers can be patched in to troubleshoot. “They can call up somebody in our customer service department and relay the information that they are seeing back over the phone or using video or pictures,” Thooft said. “And we have an option where we connect to their machine so we can live-read what is happening.”



Programming PilePro Automation on a TeleStacker Conveyor requires minimal information, such as the maximum clockwise or counterclockwise travel length and the extension height increment. (Photo: Superior Industries)