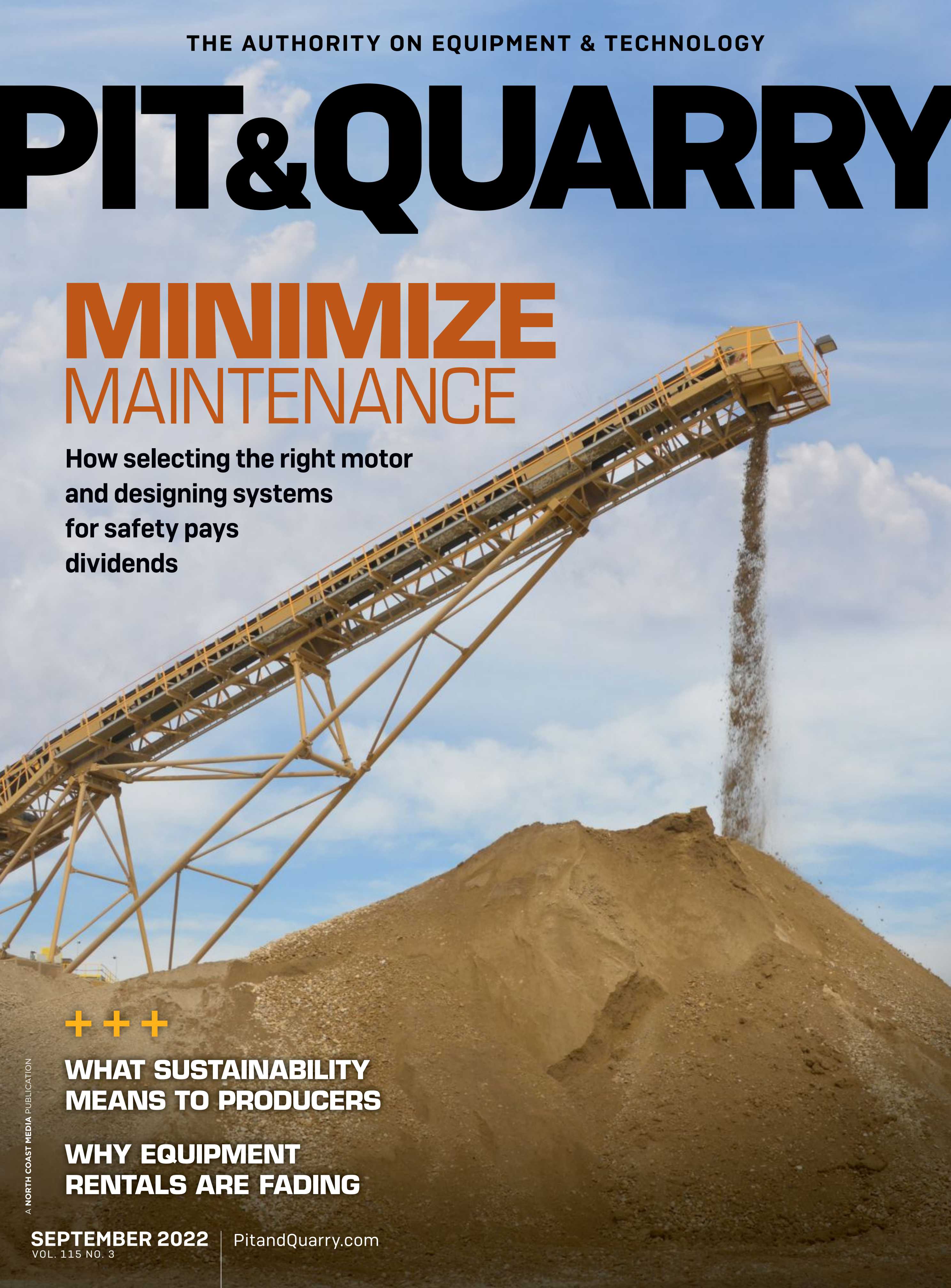

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MINIMIZE MAINTENANCE

How selecting the right motor and designing systems for safety pays dividends

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WHAT SUSTAINABILITY MEANS TO PRODUCERS

WHY EQUIPMENT RENTALS ARE FADING

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Taking safety into account when designing a conveyor system can increase its overall life cycle.

DESIGNING FOR SAFETY

Safety must be the top priority when manufacturing or selecting conveyor systems

BY TODD SWINDERMAN

Conveyors are among the most dynamic and potentially dangerous equipment at a quarry or materials-processing site.

Even though conveyor safety and performance is critical to an operation's success, the impact of its contribution to overall efficiency is often unrecognized by management and workers alike. The operational basics of belt conveyor systems are too often a mystery to employees with little understanding about the hardware installed and the performance required from the components.

The knowledge gap is understandable. The attention of personnel at a quarry is centered on the processing of the company's main products. The "care and feeding" of belt conveyors – that is, the adjustment, maintenance and troubleshooting that make a huge difference in safety, performance and profitability – is typically outside of their expertise. Sometimes, the ongoing maintenance and service of these systems is simply not part of their immediate focus or within their time constraints.

PROTECTING VALUABLE ASSETS

People are the single-most-important resource of any industrial operation, and engineers and designers are working to incorporate greater functionality into designs to improve safety.

Standards continue to tighten as the Mine Safety & Health Administration and Occupational Safety & Health Administration retain a focus on worker safety, further driving a need for equipment that's designed with safety as its fundamental priority. At the same time, there is growing pressure for continuous and ever-increasing production.

When examining a system's safety, improving efficiency and reducing risk can be achieved by using a hierarchy of control methods to alleviate hazards. The consensus among safety professionals is

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that the most effective way to mitigate risks is to design the hazard out of the component or system. This usually requires a greater initial capital investment than short-term fixes yet yields more durable, cost-effective results.

Safety improves as the type of hazard control moves up the hierarchy of methods. Experienced engineers often recommend operators retain an outside firm to examine system requirements and design new equipment around historical issues and an application's specific needs.

Before the drafting phase, designers should establish the goals of reducing injuries and exposure to hazards such as dust and spillage to increase conveyor uptime and productivity, as well as seek more effective approaches to ongoing operating and maintenance challenges.

Designs should also be forward-thinking: exceeding compliance standards and enhancing operators' abilities to easily and cost-effectively incorporate future upgrades by taking a modular approach.

One example is to incorporate longer, taller and tightly sealed loading chutes to control dust and spillage or heavy-duty primary and secondary cleaners to minimize carryback.

By using hazard identification and risk-assessment methods early in the design process, engineers can create the safest, most efficient system for the space, budget and application.

POWER

Another trend in large operations is enhanced automation and monitoring for tasks such as load sensing, belt tracking, cleaner tensioning and lighting. In most cases, electrical power is supplied only where it's needed on a conveyor system, such as the drive motor, and it is not typically available for general-purpose use.

In many operations, a lack of available power means any monitoring of the conveyor must be done by technicians physically walking the length of the structure. This, however, can be difficult and time consuming on long systems spanning difficult terrain.

It is more efficient to employ sensors to transmit important data from remote points to a central location, where it can be monitored in real time and recorded for later analysis. But intelligent monitoring systems for conveyor systems require power for extended operation.

Due to the distances involved, cabled communication systems are not ideal, and therefore, wireless communication systems are more advantageous. Options such as solar are not well suited to the general conditions of a conveyor system, as monitoring devices are often required in a dark, enclosed structure or for continuous operation day and night.

Improving efficiency and reducing risk can be achieved by using a hierarchy of control methods for alleviating hazards.

A conveyor is driven by a multi-kilowatt motor, and this power is readily available systemwide in the form of the moving belt. The motors driving the belts are typically sized with a considerable power safety factor to account for parasitic loads, such as rolls with damaged bearings, tracking devices, sealing systems, belt cleaners and material changes.

For these reasons, engineers have searched for ways to take advantage of the available kinetic energy of the moving belt, bringing power to the specific places where sensors and other devices would provide advantages.

One approach to obtain electrical power from the belt's energy is to run a wheel along the belt surface that acts much like the small dynamo powering a bicycle light, spinning via contact with the belt surface.

Unfortunately, conveyor systems are rarely a pristine environment and, in most operations, some bulk material leaves the belt as dust and spillage, building up on the rollers and conveyor structure below the belt. This fugitive material rapidly adheres to the generator wheel, causing a host of problems such as vibration, excessive rolling inertia and high shaft loads.

In most conveyor designs, the belt runs on a set of rollers that provides support and guides the belt. Product designers theorized that they could draw power from a moving belt by attaching an independent generator directly to one of the rollers.

Product engineers developed a design to accomplish this through the use of a magnetic coupling that attaches to the end of an existing roller. The outside diameter of the generator matches the diameter of the roll but places the generator outside the material path to avoid the heavy loads and fugitive material that tends to damage existing design attempts. The roll generator is held in a fixed position by the roll-support system, but it is not normally required to bear any of the material load.

Conveyor roll loads are carried by a large support shaft in the generator, which does not rotate and is rigidly mounted to the idler support structure. The generator forms a lightweight driven unit that does not affect the existing roll in any way, except to be rotationally engaged via the magnets and draw a small amount of mechanical power to generate electrical energy. The generator is sealed from fugitive material and forms an integral unit independent of the conveyor roll.

LOW-BID PROCESS VERSUS LIFE CYCLE COST

The low-bid process is generally not explicitly stated, yet it's an implied rule baked into a company's culture.

The process encourages bidders to follow a belt conveyor design methodology based on getting the maximum load on the belt and the minimum compliance with regulations while using the lowest-priced materials, components and manufacturing processes available.

Maximizing cargo volume and minimizing the price of a system usually means selecting the narrowest possible belt while operating at the highest speed possible. This, in many cases, results in chute plugging, excessive spillage and reduced equipment life.

When companies buy on price, the benefits are often short-lived and costs increase over time, eventually resulting in losses. In contrast, when purchases are made based on lowest long-term cost, the benefits usually continue to accrue and costs are lower. This results in a net savings over time.

DESIGN HIERARCHY

To safely maximize production, designers and engineers should approach projects with specific priorities.

Rather than meeting minimum compliance standards, a conveyor system should exceed all code, safety and regulatory requirements using global best practices. By designing the system

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to minimize risk and the escape and accumulation of fugitive material, the workplace is made safer and the equipment is easier to maintain.

Life cycle costing should play into all component decisions. Be aware of specifications on project components that state "specific manufacturer's name/or equal." Vaguely written "or equal" specifications exist for competitive reasons and allow contractors to purchase on price without adequate consideration for construction or performance.

FINALLY

Engineering safer conveyors is a long-term strategy. Although design absorbs less than 10 percent of the total budget of a project, the engineering, procurement and construction management services can account for as much as 15 percent of the installation cost of a major project.

By encouraging the use of the hierarchy of controls at the planning stage, as well as the design hierarchy at the design stage, the installation of an evolved basic conveyor can be achieved. The system will likely meet the demands of modern production and safety regulations, with a longer operational life, fewer stoppages and a lower cost of operation. **P&Q**

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