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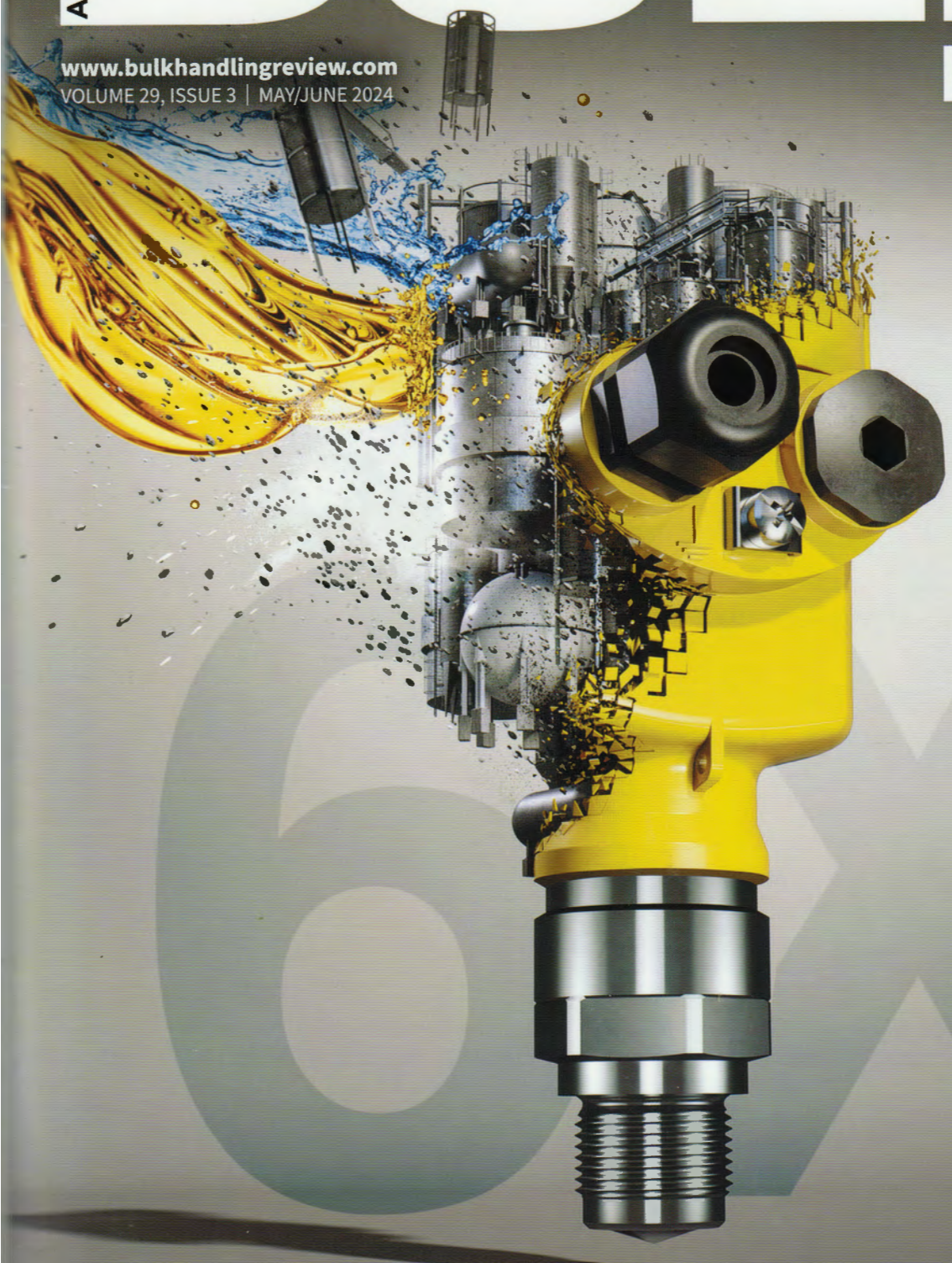

Remote transfer points: Monitoring and servicing long conveyors

John Barickman, senior product development engineer at Martin Engineering, explains the logistical and maintenance considerations required for kilometre-long conveyors.

WESTERN AUSTRALIA IS HOME to one of the longest continuous belt conveyor in the world, running between the Mount Saddleback mine and the Worsley refinery near Collie.

Travelling more than 50 kilometres during its winding journey through 22 tunnels and 10 bridges, the system transports around 2700 tonnes of bauxite ore for aluminium extraction.

Monitoring and servicing a system like this can be onerous, but the alternative is trucking. The reduction in cost for labour, fuel, vehicle maintenance, and road upkeep to retain that volume of production, including greatly improving workplace safety, justifies an extensive conveyor system.

However, since its construction in 1983, operators have found that one continuous belt may not be the greatest design decision.

Andrew Timmerman, engineering supervisor at Martin Engineering said a fleet of trucks involves several logistical factors such as the need for experienced drivers, trained mechanics, safe roads, and a lot of fuel.

"Long conveyor systems are designed to reduce some of the cost and safety issues. But like any solution, they have their challenges, too," he said.

More and more, belt conveyors are being built that are kilometres long. They descend mountains and cross vast stretches of plains, forests, or jungles.

Built to compensate for expensive, slow, and potentially dangerous haulage by trucks, long conveyors travel at high speeds regardless of the weather.

Intersecting conveyors and system accessibility

Access to a transfer point by vehicle is recommended, if not critical, because of the nature of the most common maintenance tasks which could involve heavy lifting and work with power tools such as cutters and grinders.

Discharge and loading zones experience the largest amount of spillage, and fugitive material can quickly pile up and encapsulate the belt, causing dust emissions and idler fouling. Maintenance staff needs to access the area to make adjustments to remedy causes of carryback and spillage and clear away accumulation.

Properly engineered material transfer includes belt cleaning, sealing, chute clog prevention, impact management, tracking and monitoring to control the need for maintenance and unscheduled downtime. A goal should be to minimise the number of trips and address all issues in a single visit.

A long conveyor can transport bulk material faster and more consistently than vehicles. Images: Martin Engineering

Images: Martin Engineering

Transfer point maintenance

Transfer points can take some care to maintain. The most common ongoing transfer point maintenance tasks are:

- Primary and secondary belt cleaner blade replacement
- Cleaner performance monitoring and tensioner adjustments
- Spillage cleanup
- Transfer chute maintenance and clog mitigation

Having to frequently maintain a basic belt cleaner to make sure it is adequately tensioned and cleaning properly is costlier in labour over the long run than installing quality belt cleaning equipment upfront. This is known as Return on Performance (ROP), which differs from Return on Investment (ROI) in that it calculates the savings in labour for maintenance and equipment life over the long term, instead of merely the period in which the initial capital investment is recovered regardless of increased costs and replacements afterward. At a transfer point located miles away, having a reliable belt cleaner tensioning system that is self-adjusting and/or low maintenance drastically reduces the cost of operation.

Safety and accessibility rules may require hand rails and grated walkways.

Transfer chutes can experience buildup due to material properties, lump/particle size, moisture content, temperature, abrasiveness and corrosiveness. When clogs happen, production stops and backflow fouls components in the discharge zone and spills over the edges of the system. Due to the distance and equipment needed on extended conveyor lengths, the unscheduled downtime and associated costs can be excessive.

Equipment reliability at transfer points

"Quality and durability are key elements for a sustainable remote transfer point," Timmerman said.

"Getting to the work site alone increases the cost of maintenance, so calculating the ROP on low maintenance equipment may be a better metric than ROI."

Equipment geared toward mitigating common transfer chute issues can include service-friendly primary and secondary cleaners, autonomous tensioners, belt alignment devices, self-adjusting skirting, vibration, and localised power generation.

Service-friendly primary and secondary cleaners are track-mounted components that pull away from the stringer for safe service outside of the system. After performing the proper lock-out/tag-out/block-out/test-out procedures, a single worker has easy access to safely service the blades using basic tools.

Low maintenance primary and secondary cleaners are tensioned upon installation and with no need for further adjustment. Positioned at an angle across the discharge pulley, it has a rubber strip constructed with tungsten carbide tips, requiring less maintenance

A non-tensioning belt cleaner takes a unique approach to how the devices are designed.

and delivering as much as four times the blade life of conventional designs.

Belt alignment devices ensure that the belt and the cargo remain centred, which is especially critical in loading and discharge zones. Standard OEM belt training devices impede the belt from drifting into the stringer but it is up to the operator to adjust the belt path through slight adjustments of the idlers down the system. On long conveyors, automatic belt training is essential both on the carrying side and the return side to mitigate mistracking from wind, shifting cargo, and various other causes.

Self-adjusting skirting rides the belt to create an effective seal automatically. Historically, skirting had to be adjusted when excessive dust and spillage escaped from the loading zone. Self-adjusting designs prevent spillage and equipment breakdown caused by fugitive material, creating a constant tight seal to the belt. The unit self-adjusts to rubber skirt wear, regardless of material volume and size diversity, delivering an adaptable and low-maintenance solution.

Monitoring and sensors

In addition to cameras that provide an overall view of conditions, sensors monitor operations and flow, delivering important data. One thing to keep in mind is the need to relay the information to a central control centre via Global System for Mobile Communications (GSM), which requires the proper equipment and power.

A belt cleaner position indicator is an intuitive sensor that allows remote monitoring of the belt cleaner blade position and remaining service life, notifying operators when re-tensioning or blade replacement is required. A position indicator can be mounted anywhere from three to 800 metres from the cellular gateway, and the robust, sealed construction means it is virtually immune from damage.

Up to 50 units can be monitored by a single gateway connecting to the Internet, usually located at the highest point in the plant, where the cell signal is strongest. The system communicates via radio frequency from each sensor to the gateway.

Load sensors are specifically geared to communicate with automated tensioning systems so the unit can pull the blade away from the belt when there is no cargo. Running a cleaner on an empty belt can reduce blade life, degrade the belt face, and create potentially dangerous friction heat and static.

Flow indicators or "plugged chute detectors" can either alert operators to the need for maintenance or automatically activate flow devices like vibrators or air cannons to disrupt stuck material and commence flow without worker intervention.

Service and safety

Each piece of equipment requires a knowledgeable and trained technician for safe service. As a result, performing maintenance on a remote transfer point might involve the most experienced technicians in the facility for long periods to inspect and maintain it. Additionally, it could require a fully equipped service truck with lifts and onboard power.

Many operators have turned to specialty service contractors who are trained and equipped to safely conduct regular inspections, provide maintenance, and offer recommendations. These highly trained and certified technicians can reduce replacement equipment lead times and perform maintenance tasks faster, minimising downtime.

To improve response time, many systems can be set up so technicians can be alerted through the GSM to issues at the same time as operators. Some service contractors can even maintain data logs on customers' conveyors, recording system specifications, status details and service procedures performed. The collected information is helpful in scheduling preventive maintenance activities and in determining when outside resources should be utilised. This data can be used to better manage an operation's equipment and budget.

Improving efficiency and operating costs

Due to power and logistical issues, not every conveyor is going to be as ambitious as the Mount Saddleback mine. Most, if not all, will have several transitions. Well-monitored autonomous equipment can make a remote transfer point much more cost-effective to operate. ROP-minded design and maintenance performed by trained service technicians can mitigate many of the disruptive issues and downtime associated with transfer points in general.

"Long conveyors with multiple transfer points have been around for several decades, and equipment designs for this unique environment have evolved in recent years," Timmerman said.

"By focusing on safety, ease of service and reduced risk exposure, operators are realising that many of the most troubling issues can be effectively resolved." B