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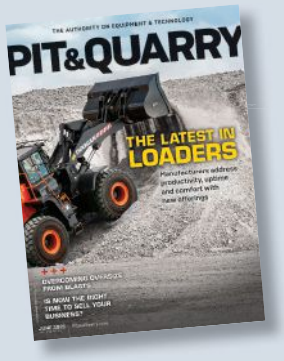

UP FRONT

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Doosan (cover photo); Martin Engineering (top); loops7/E+/Getty Images; daz2d (background), ISMODE/iStock / Getty Images Plus/Getty Images (grunge background)

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MAINTAINING LONG CONVEYORS

A long conveyor can transport bulk material faster and more consistently than vehicles.

ALL IMAGES: MARTIN ENGINEERING

There are a number of challenges to consider when it comes to monitoring and servicing remote transfer points

BY **JOHN BARICKMAN**

An online search for images of the Bou Craa conveyor reveals satellite photos of the longest belt-driven bulk handling system in the world.

Stretching across the desert for 61 miles, the conveyor transports phosphate from the Bou Craa mine in the Western Sahara region to Africa's northwest coast just south of Morocco.

It's not the length of the conveyor that allows it to be seen from space, though. Instead, it's a distinctive white dust trail that extends as far as 1.5 miles south of the belt that's caused by northerly winds.

Beyond dust emissions, there are a number logistical and maintenance considerations for long conveyors. Built to compensate for expensive, slow and potentially dangerous haulage by trucks, long conveyors often stretch down mountains, through woods and across plains – traveling at high speeds regardless of the weather. This appeals to operators for several reasons: reduced maintenance, less labor, increased production, improved safety, and a lower cost of operation.

"We've observed that a fleet of trucks involves several logistical factors such as the need for experienced drivers, trained mechanics, safe roads and a lot of fuel," says Andrew Timmerman, engineering supervisor at Martin Engineering. "Long conveyor systems are designed to reduce some of the cost and safety issues. But, like any solution, they have their challenges, too."

BULK HANDLING LOGISTICS

A priority of any bulk handler should be workplace safety and mitigating or avoiding possible hazards.

Vehicle transport relies on a fleet of trucks and trained drivers – in some cases sharing public roads – and is directly affected by weather conditions. This increases an operator's potential liability exposure and insurance costs.

Comparing worker deaths between large trucks (those greater than 10,000 pounds) and conveyor bulk material transport using 2018 U.S. National Highway Traffic Safety Administration workplace safety data and 2018 Mine Safety & Health Administration data reveals 885 vehicular deaths versus only 14 conveyor deaths in the same year. Even if only 25 percent of the vehicular deaths (221 incidents) were in trucks transporting raw bulk material, it would still be a 15-fold increase in fatalities over conveyors.

Still, even with the massive discrepancy in fatalities between the two methods, conveyors can still be dangerous. Recorded injuries and deaths are most prevalent at the loading zones and discharge zones.

INTERSECTING CONVEYORS & SYSTEM ACCESSIBILITY

Access is critical with virtually any conveyor, according to Timmerman.

"No matter how well the system is running, transfer points will need to be inspected and serviced at least every six months," he says.

On long conveyors, a transfer point is generally required:

- When there's a change in system direction. Belt conveyors are generally straight lines. To circumvent obstacles, reach established road access points or avoid unauthorized areas, cargo must be transferred onto another belt traveling in a straight line in the new direction.
- When there's a change in belt type

or speed. Some systems require transfer to a cleated belt for steep angles or a faster belt to increase tonnage.

▪ When the pulley drive motor reaches the max load and torque limit. To avoid running power over long distances to booster pulleys, a long conveyor may be split with one drive at the head pulley and another at the tail pulley to share the power load. Even if booster drives are used, they create additional transfer points.

▪ When the cargo is split or redirected to several areas. Some operators separate cargo to other processes (i.e., different crushers, mills) or divert some material to a stacker conveyor for stockpiling.

▪ At the final point of discharge. Because the final point of discharge is likely within a staffed facility or storage area, many of the equipment and monitoring concepts could apply. But this transfer point would not be considered "remote."

Access to a transfer point by vehicle is recommended, if not critical, because of the nature of the most common maintenance tasks that 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 minimize the number of trips and address all issues in a single visit.

TRANSFER POINT MAINTENANCE

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

▪ Primary and secondary cleaner blade replacement

▪ Cleaner performance monitoring and tensioner adjustments

▪ Spillage cleanup

▪ Transfer chute maintenance and clog mitigation

Many of today's urethane blade designs are highly effective at removing adhered material from the belt and controlling carryback. Cleaning is essential, because cargo pressure and material moisture content on the carrying side can cause the material to cling to the

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This remote material flow sensor is powered by an idler roll generator.

belt after discharge.

As a result, spillage drops off during the return run, releasing dust and fines over the entire length of the system. Interesting as it might be to see a conveyor system from space, no operator wants attention from inspectors because of dust.

Having to frequently maintain a basic belt cleaner to make sure it is adequately tensioned and cleaning properly is costlier in labor 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 labor 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.

Shoveling spillage is something that can be done on an ongoing basis, but for remote transfer points where fugitive material has built up over time, the job requires transporting personnel and equipment to the site. Allowing volumes of spillage to build up may lead to permit violations for airborne emissions and wastewater runoff, so sealing the transfer point to mitigate spillage saves in both labor and possible fines.

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 says.

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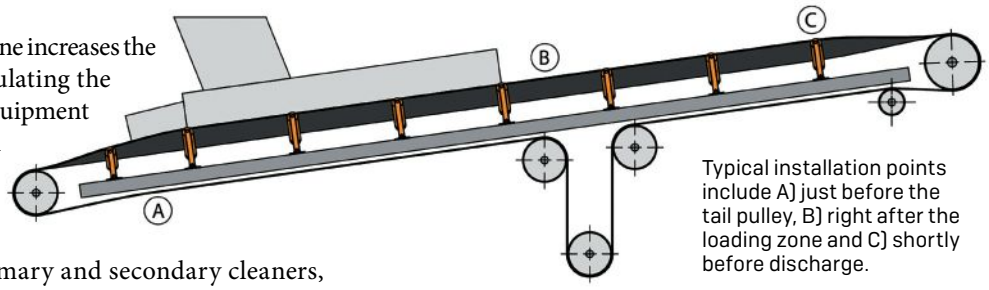
"Getting to the worksite alone increases the cost of maintenance, so calculating the ROP on low-maintenance equipment may be a better metric than ROI," he says.

Equipment geared toward mitigating common transfer chute issues can include primary and secondary cleaners, autonomous tensioners, belt alignment devices, self-adjusting skirting, vibration and localized 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 lockout/tagout/block-out/test-out procedures, a single worker has easy access to safely service the blades using basic tools.

Autonomous tensioning is a relatively new concept that monitors the blade's contact with the belt and automatically adjusts the tension. This ensures consistent pressure and optimum performance, reducing the amount of spillage and carryback. It eliminates the need for ongoing tensioner maintenance, reduces the amount of spillage from carryback, and lowers dust emissions along the belt path.



Typical installation points include A) just before the tail pulley, B) right after the loading zone and C) shortly before discharge.

Belt alignment devices ensure the belt and cargo remain centered, which is especially critical in loading and discharge zones. Standard belt training devices either impede the belt from drifting into the stringer or react to the belt drift. On long conveyors, belt trainers are required along the belt path both on the carrying side and the return to mitigate mistracking.

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.

Applied vibration helps prevent the buildup of dust and fines on the inner walls of the transfer chute. Clogging can bring an operation to a stop, causing excessive downtime. But disrupting and loosening material helps to prevent accumulation, which can lead to backflow and spillage.

MONITORING & SENSORS

In addition to cameras that provide an overall view of conditions, sensors monitor operations and flow, delivering important data.

A position indicator is an intuitive sensor that allows remote monitoring of the belt cleaner blade position and remaining service life, notifying operators when retensioning or blade replacement is required. A position indicator can be mounted anywhere from 10 to 2,625 ft. 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 does not require a cellular line for each position indicator, instead communicating 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 about the need for maintenance or automatically activate flow devices such as vibrators or air cannons to disrupt stuck material and commence flow without worker intervention. **P&Q**

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