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International Cement review

Panel discussion:
Alternative fuels in the United States

WE HAVE THE TECHNOLOGY, BUT WHERE IS THE FUEL?

Staying on the right track

When the Ash Grove Cement plant in Chanute, Kansas, USA, experienced involuntary shutdowns and rising costs due to belt drifts, the solution came in the form of modern belt tracking technology. The upgrade has reduced belt damage, spillage and downtime.

■ *by **Cory Goldbeck**, Martin Engineering, USA*

The belt on a conveyor can either gradually inch its way out of alignment or suddenly – without warning – lurch sideways and get shredded against the stringer. In some cases, the belt will realign itself or activate a stop switch, shutting the entire system down. The worst outcome is when the contact between the belt and the stringer causes enough friction to ignite the cargo or belt and convey a fire quickly through the facility. Either way, the general result of belt mistracking is hazardous and expensive.

The Ash Grove Cement plant in Chanute, Kansas, USA, has received dozens of safety awards since the facility's modernisation in 2001. However, when operators experienced several frustrating involuntary shutdowns and rising costs from drifting belts, prevention-minded managers sought an innovative solution.

"Although there was one belt that had a particular issue with tripping the emergency stop switch, mistracking was a problem on several belts from the limestone quarry all the way to the raw mill," explained Danny Wolken, maintenance planner at Ash Grove Chanute. "We have different materials converging into a single area, and disruption to the flow affects the productivity of the whole system."

Conveying capabilities

After several modernisations through the decades, the Ash Grove Chanute plant currently has a clinker capacity of 1.628Mta. It also has the distinction of being the first cement kiln in the USA to utilise 20-25 per cent of alternative fuels in its fuel mix, reducing fossil fuels usage.

Various materials from the storage dome are carried approximately 350m (1150ft) on eight belts to the raw mill for mixing and insertion into the preheater for calcining in the kiln. With an average belt width of 914mm (36in) running at ~1.9m/s (375fpm), the system transports ~453tph (500stph) of material. The outdoor conveyors are covered to protect cargo from the variable Kansas weather patterns.

The outdoor conveyors are covered to protect cargo from the weather

Obstacles to efficiency

The belt carrying limestone was of particular concern. After passing through the crusher, ≤100mm (-4in) aggregate would be loaded onto the conveyor. After leaving the settling zone, the belt had a tendency to crawl up on the side of the idlers. This would disrupt the centred distribution of the material on the belt, causing smaller aggregate to spill along the length of the system until the belt drifted far enough to activate the stop switch, which shut down the conveyor.

Stop switches are sensors that are installed at intervals along the length of the conveyor on both sides of the belt near the outer limit of a safe belt path. The wandering belt pushes a lever arm and activates a switch, which either sets off an alarm or, in Ash Grove's case, interrupts the conveyor's power circuit, stopping the system. Costly downtime and lost production make these devices less of a solution to the misalignment and more of an indicator of a severe problem.

The shutdown would have a ripple effect throughout the plant. During the unscheduled downtime, several maintenance workers would drop what they were doing, rush to the area, go through the lock-out/tag-out/block-out/test-out procedure and then manually realign the belt. "This one conveyor hit the stop switch 26 times last year, for a total of 17h of downtime," Mr Wolken noted. "Although the limestone conveyor had the worst problems, issues with tracking stretched across all eight conveyors. That adds up, since we run 10h a day, seven days a week."

Along with excessive unscheduled downtime, the belt on the limestone conveyor began to fray from contact with the structural components of the system. Having only been replaced six months earlier, labour, downtime and equipment expense made belting one of the costliest components of the system. Incidental contact drastically reduces the belt life and can degrade the splice. The belt damage likely contributed to further misalignment and spillage.

Adding to the issue, every 45 days or so several workers dedicated about 50h of time to clean under and around the structural supports of the eight systems.

This helped mitigate accumulation that could potentially encapsulate the belt and kept the area safe.

"The regular cleaning and the stop switch helped protect workers and saved the system from more serious damage," Mr Wolken said. "But mistracking was also impacting productivity and the cost of operation, so we needed an alternative."

System diagnosis

With a long-standing relationship of providing quality equipment and service, Martin Engineering was asked to inspect the systems and offer solutions. Technicians walked the belts individually and took detailed notes on the unique causes of mistracking for each system.

"We were already extremely familiar with these conveyor systems, since we also service and install belt cleaners at the plant through our Mr Blade programme," said Rich Merritt, field technician for Martin Engineering. "We had an idea of where and how the conveyors were having tracking problems. Walking the belt and filling out a detailed checklist helped solidify those assumptions and revealed some specific details we might have missed, so it pays to be thorough."

Firstly, technicians found that when the belt drifted, cargo shifted downward to one side of the belt, causing it to mistrack further. The material lost surface area and spilled over the edge of the belt. The spillage dropped along the entire length of the system, causing product loss, creating potential workplace safety issues and requiring excessive clean-up.

Secondly, technicians suspected some potential manufacturing flaws of the belt attached to the limestone conveyor. If the belt is not precisely engineered or properly stored, it can bow or camber (see Figure 1). This might have contributed to the tracking and belt damage issues.

Moreover, the extreme temperatures and high winds common to Kansas can impact belt alignment. Ash Grove enclosed the conveyors specifically to provide shelter against the prevailing wind, which helped minimise dust emissions and frozen idlers, but changing temperatures can still cause components to expand and contract, with changes in friction and functionality.

Belt manufacturing issues may have also contributed to the 'cupping' observed by the technicians. Commonly seen on the return side of the belt, cupping is when the belt curls on either edge, reducing the surface contact and tension with rollers, causing it to drift. A wider drift area means the belt can be wildly off-course by the time it encounters tracking equipment, making the force and angle of the belt nearly impossible to correct.

Finally, the existing tracking systems were found to be inadequate. They delivered only minor corrections to discourage belt damage and quite often broke, requiring additional maintenance. Technicians realised that the belt's return run also needed a solution for the whole system to remain in line.

The Martin® Tracker™ for the carrying side adjusts to fit the system's trough angle

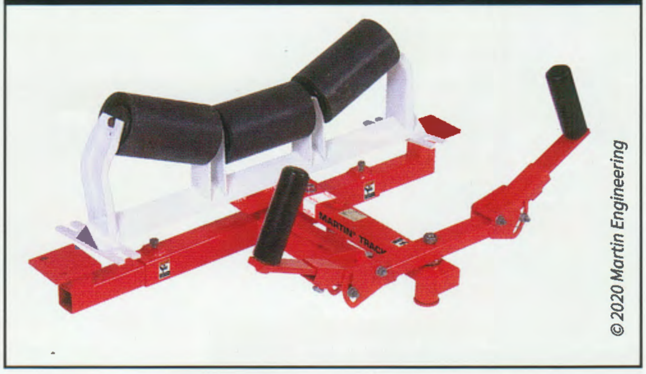
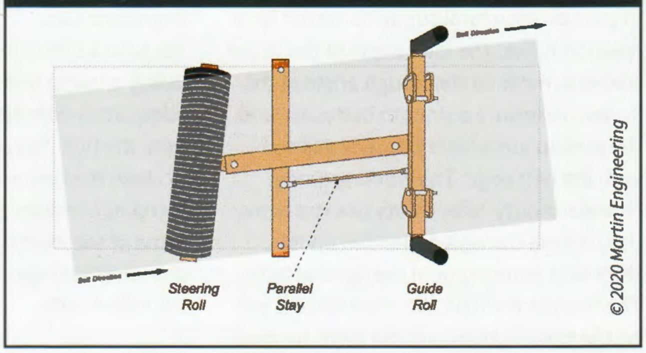


Figure 2: the tracker pivots against the mistracking, using the force and weight of the belt to redirect it



Preventive solutions

Martin Engineering technicians pinpointed the problem areas on each of the conveyor belts and offered a solution that utilised modern belt tracking technology where it was needed. "Across the eight conveyors, we recommended installing 28 Martin Trackers," Mr Merritt said. "Many of the units control the belt return, but there are also upper trackers strategically placed in problem areas."

Utilising multiple-pivot, torque-multiplying technology, the Martin® Tracker™ has two sensing arms that extend out to either side of the conveyor with rollers at the tip, which smoothly ride the edges of the belt. The sensing arms detect slight variations in alignment and use the force of the belt to immediately pivot the position of the troughed idlers against the misalignment with equal force, thus returning the belt to its intended path (see Figure 2).

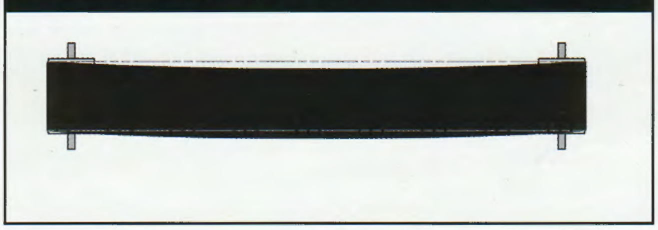
With its sensitivity to misalignment, less opposing force is needed for the equipment to realign the belt. Early detection with a reduced range of drift before correction makes the belt run more efficiently, mitigates spillage and results in longer equipment life.

The lower trackers have a flat roller with a polyurethane coating. Raised slightly above the belt plane, the roller acts partly as support with just enough downward force from the belt for the polyurethane to grip the belt and return it into alignment.

Installation

The installation was performed by two Martin Engineering technicians during scheduled downtime. Since edges of the belt on the limestone conveyor had serious damage caused by the mistracking, another team replaced the belt as well. The new belt was thoroughly inspected to ensure that it did not contribute to tracking issues.

Figure 1: camber happens in the manufacturing process, and belts should be inspected prior to installation




The return side Martin Tracker lifts the belt slightly for appropriate contact


The tracker has minimal impact on the stringer structure

Trackers were installed with minimal impact on structural supports except for a few bolt holes. The idler angle of the upper trackers matched the trough angle of the system to ensure a smooth belt path, and the torsion arms were properly aligned with the belt edge. The working grade (standard-duty, heavy-duty or extra heavy duty) of the trackers depended on the thickness and weight of the specific belt. The heavier the belt, the more force is put on the torsion arms and the pivot support, requiring proportional reinforcement. If the unit is not properly matched to the belt weight, it may not be able to adjust quickly enough.

Three critical areas on the conveyor required tracking: the exit of the settling zone, the entrance to the feed mill and along the return path. A lower tracker placed along the belt path and near the loading zone ensures the belt is aligned as it hits the tail pulley to promote centred loading. An upper troughed tracker at the settling zone exit reinforces a straight belt path as it travels the length of the system.

One of the most difficult installations involved the trackers placed at the entrance to the feed mill. Raised off the ground in the weighing tower, the technicians required some extra safety equipment and time to install those units. This was an important step, because a centred belt entering the head pulley ensures that the belt cleaner blade adequately dislodges adhered material from the belt. Specifically positioned to clean the centre of the belt where carryback resides, belt drift may cause some of the material to avoid the blade, dropping spillage and fouling rollers along the return path.

"Observation over time revealed that the belt remained aligned through changes in weather, and none of the belts have come into contact with the emergency stop switches since the installation."

Remaining centred

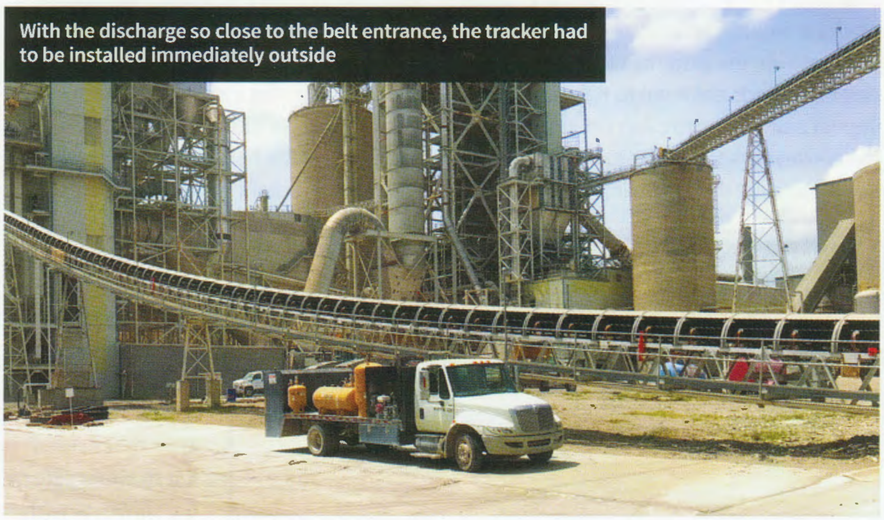
The installation of a new belt helped with testing the tracking system to ensure that the trackers are addressing cargo and transport issues and not belt flaws such as camber or cupping. Initial testing revealed positive results, with the belts remaining centred along the entire length of the system.

"Every time we replace a belt it costs approximately US$35,000 in equipment and labour, not counting the loss of production," Mr Wolken said. "Replacing the belt is not a sustainable solution, so seeing the trackers keep the belt in line was a positive result."

The belt remained centred from pulley to pulley, drastically reducing the amount of spillage. As with any bulk handling, cleanup is always a factor, but operators pointed out that the time and labour for clean-up were significantly reduced. This improved efficiency and lowered the cost of operation.

Observation over time revealed that the belt remained aligned through changes in weather, and none of the belts have come into contact with the emergency stop switches since the installation. This has resulted in a significant reduction in unscheduled downtime, improved efficiency and eliminated the need for maintenance staff to drop everything to get the system running again.

"We trusted that Martin Engineering would be able to offer an affordable solution that could solve our problem, and they really came through," Mr Wolken concluded. "We like the trackers, so we're looking into installing them on other systems. They have definitely paid for themselves." ■


With the discharge so close to the belt entrance, the tracker had to be installed immediately outside