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Cement plant solves belt drift using highly responsive tracking equipment

Ash Grove Cement plant in Chanute, KS (USA) (© 2022 Ash Grove Cement).

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, *writes Cory Goldbeck, Territory Manager, Martin Engineering*. 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.

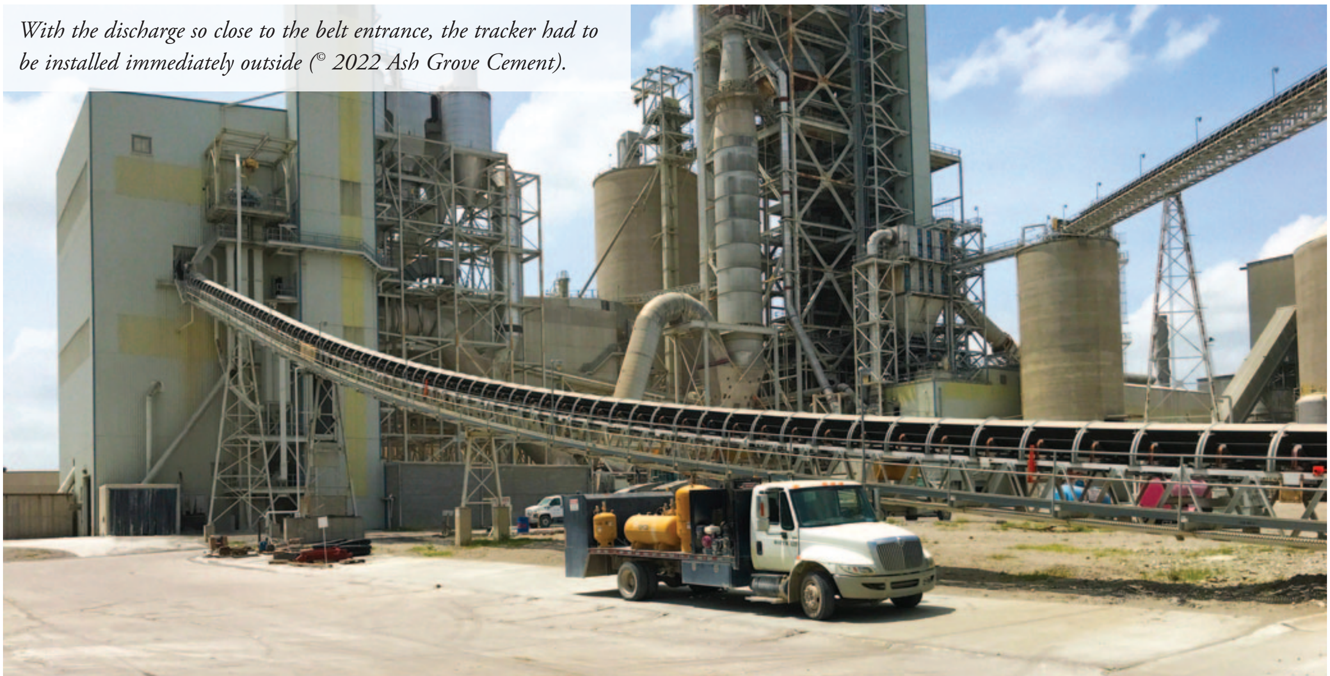
The Ash Grove Cement plant in Chanute, Kansas has received dozens of safety awards since the facility's modernization in 2001, and when operators experienced several frustrating involuntary shutdowns and rising costs from drifting belts, prevention-minded managers sought an effective solution.

"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," said 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."

A long history

The Chanute plant has been in operation since 1908, producing high-quality Portland cement. After several modernizations through the decades, the plant now has a production capacity of 1,628,000 tonnes of clinker per year. It also carries the distinction of being the first cement kiln in the U.S. to utilize 20–25% alternative fuels on an annual basis, reducing the use of fossil fuels.

Various materials from the storage



With the discharge so close to the belt entrance, the tracker had to be installed immediately outside (© 2022 Ash Grove Cement).

Figure 1 – Camber can happen in the manufacturing process, and belts should be inspected prior to installation (© 2022 Martin Engineering).

dome are carried approximately 1,150 feet 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 36 inches (914mm) running at ≈375fpm [feet per minute] (1.9mps [metres per second]), the system transports ~500 tph (453mtph [metric tonnes per hour]) of material. The outdoor conveyors are covered to protect cargo from the variable Kansas weather patterns.

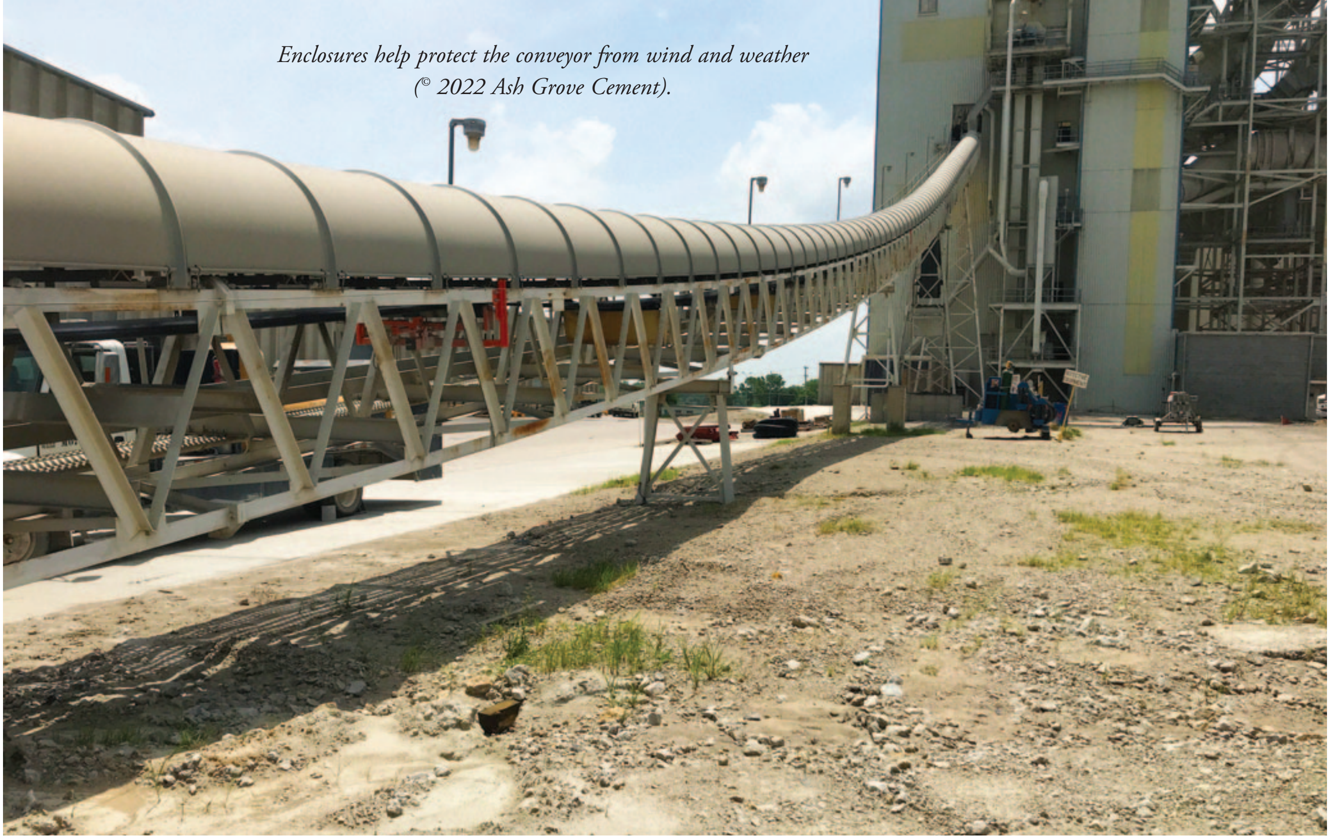
Obstacles to Efficiency

The belt carrying limestone was of particular concern. After passing through the crusher, four inch-minus (≤100mm) 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 17 hours of downtime," Wolken explained. "Although the limestone conveyor had the worst problems, issues with tracking stretched across all eight conveyors. That adds up, since we run ten hours a day, seven days a week."

Along with excessive unscheduled downtime, the belt on the limestone



Enclosures help protect the conveyor from wind and weather (© 2022 Ash Grove Cement).

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 makes 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 problem, every 45 days or so several workers dedicated about 50 hours 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," 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 program," said Jacob Taylor, Service 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."

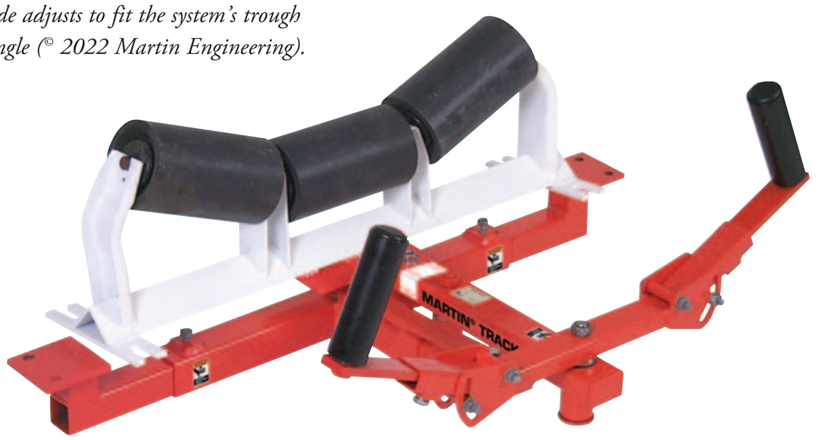
First, technicians found that when the belt drifted, cargo shifted downward to one side of the belt, causing it to mistrack further. The material lost surface area and spilled over the edge of the belt. The spillage dropped along the entire length of the system, causing product loss, creating potential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

Second, technicians suspected some potential manufacturing flaws of the belt attached to the limestone conveyor. If the belt isn't precisely engineered or properly stored, it can bow or camber. [Fig.1] This might have contributed to the tracking and belt damage issues.

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

Fourth, 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 Martin® Tracker™ for the carrying side adjusts to fit the system's trough angle (© 2022 Martin Engineering).



the belt nearly impossible to correct.

Fifth, 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 realized that the belt's return run also needed a solution for the whole system to remain in line.

Preventative solutions

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

Utilizing innovative 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. [Fig.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.

The Martin Tracker has minimal impact on the stringer structure (© 2022 Martin Engineering).

Installation

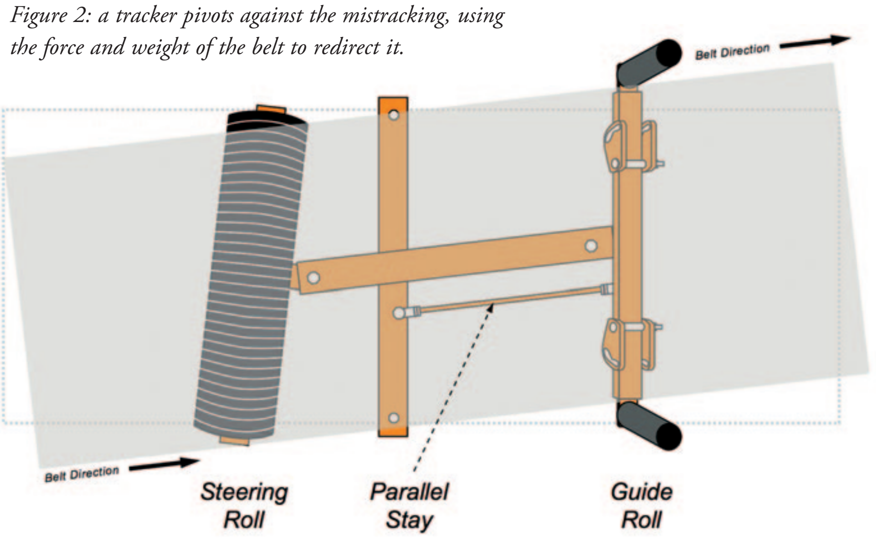
The installation was performed by two Martin technicians during scheduled downtime. Since edges of the belt on the limestone conveyor had serious damage caused by the mistracking, another team replaced the belt as well. The new belt was thoroughly inspected to ensure that it did not contribute to tracking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

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 centered 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 centered belt entering the head pulley ensures that the belt cleaner blade adequately dislodges adhered material from the belt. Specifically positioned to clean the center 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.

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



The return side Martin Tracker lifts the belt slightly for appropriate contact (© 2022 Martin Engineering).

Staying 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 centered along the entire length of the system.

"Every time we replace a belt it costs approximately $35,000 in equipment and labour, not counting the loss of production," 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 centered 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 cleanup 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 in 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 interrupt their work 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," Wolken concluded. "We like the trackers, so we're looking into installing them on other systems. They have definitely paid for themselves."

About Martin Engineering

Martin Engineering is a global innovator in the bulk material handling industry, developing new solutions to common problems and participating in industry organizations to improve safety and productivity. The company's series of *Foundations* books is an internationally recognized resource for safety, maintenance and operations training — with more than 20,000 print copies in circulation around the world. The entire 500+ page volumes can also be downloaded as free PDFs from the Martin web site. Martin Engineering products, sales, service and training are available from 19 factory-owned facilities worldwide, with wholly-owned business units in Australia, Brazil, Chile, China, Colombia, France, Germany, India, Indonesia, Italy, Japan, Mexico, Peru, Spain, South Africa, Turkey, the USA and UK. The firm employs more than 1,000 people, approximately 400 of whom hold advanced degrees.