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# EFFICIENT PLANT

OPTIMIZING MANUFACTURING SYSTEMS

## Condition Monitoring



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Design advances correct issues, such as belt misalignment and cleaning, that become significant factors when conveyor speeds increase.

# Innovation Meets Future Conveyor Needs

**Monitoring and automation advances make it possible to increase conveyor speeds without sacrificing safety or efficiency.**

R. Todd Swinderman
Martin Engineering

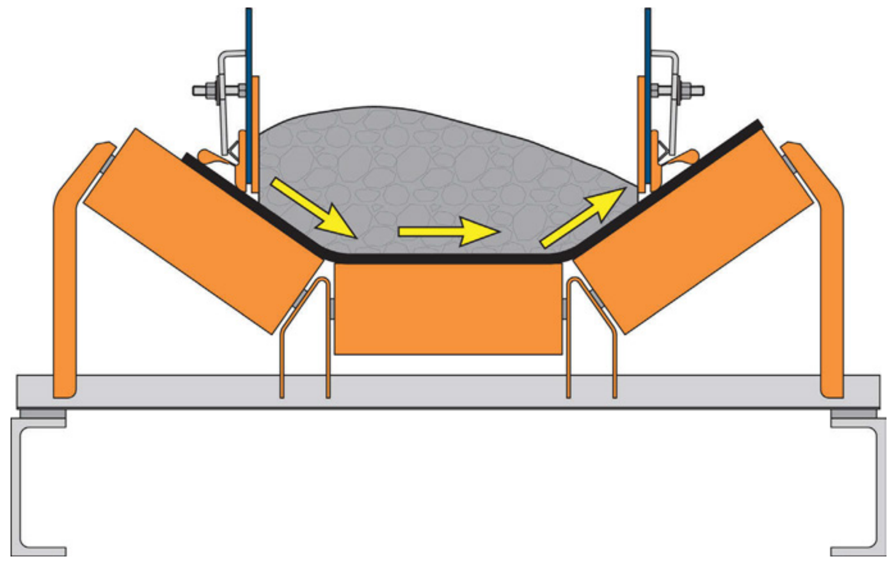
HIGHER PRODUCTION DEMANDS across all bulk-handling segments require increased efficiency at the lowest cost of operation, in the safest and most effective manner possible. As conveyor systems become wider, faster, and longer, more energy output and more controlled throughput is needed. Add an increasingly stringent regulatory environment, and cost-conscious plant managers must closely review which new equipment and design options align with their long-term goals for the best return on investment.

Safety is becoming a new source of cost reduction, with the percentage of mines and processing facilities having a robust safety culture likely to increase during the next 30 years to the point where it becomes the norm. In most cases, with only a marginal adjustment to belt speed, operators quickly discover unanticipated problems with existing equipment and workplace safety. These issues are commonly indicated by the larger volume of material spillage, increased dust emissions, belt misalignment, and more-frequent equipment wear/failures.

## BELT ALIGNMENT

The faster a belt moves, the quicker it can wander off its path and the harder it is for a belt tracker to compensate, leading to spillage along the entire belt path. In addition, uncentered cargo, seized idlers, or other malfunctions can cause a belt to rapidly come in contact with the mainframe, shredding the edge and potentially causing a friction fire. Beyond the workplace safety consequences, the belt can convey a fire throughout the facility at extremely high speed.

A workplace hazard that is becoming progressively more regulated is dust emissions. An increase in the volume of cargo means greater weight at higher belt speeds, increasing system vibration and leading to reduced air quality from dust. In addition, cleaning-blade efficiency declines as volumes rise, causing more fugitive emissions during the belt's return. Abrasive particulates can foul rolling components and cause them to seize, raising the possibility of a friction fire and increasing maintenance costs and downtime. Further, lower air quality can result in fines and forced stoppages by inspectors.



When a conveyor isn't center loaded, the cargo weight pushes the belt toward the more lightly loaded side. *Courtesy Martin Engineering*

## ANTICIPATING MISALIGNMENT

As belts get longer and faster, modern tracking technology becomes mandatory. The technology detects slight variations in the belt's trajectory and quickly compensates before the weight, speed, and force of the drift can overcome the tracker.

Typically mounted on the return and carry side every 70 to 150 ft. (21 to 50 m) and prior to the discharge pulley on the carry side and the tail pulley on the return, new upper and lower trackers use innovative multiple-pivot, torque-multiplying technology with a sensing-arm assembly that detects slight variations in the belt path and immediately adjusts a single flat rubber idler to bring the belt back into alignment.

## CHUTE DESIGN

To drive down the cost/ton of conveyed material, the mining sector is moving toward wider and faster conveyors. The traditional troughed design will likely remain a standard. However, with the push toward wider and higher-speed belts, the industry will need substantial development in more reliable components, such as idlers, impact beds, and chutes.

A major issue with most standard chute designs is that they are not engineered to manage escalating production demands. Bulk material unloading from a transfer chute onto a fast-moving belt can shift the flow of material in the chute, resulting in off-center loading, increasing fugitive-material spillage, and elevated dust levels, well after leaving the settling zone. The result of off-center loading is mis-tracking and spillage around the system and walkways.

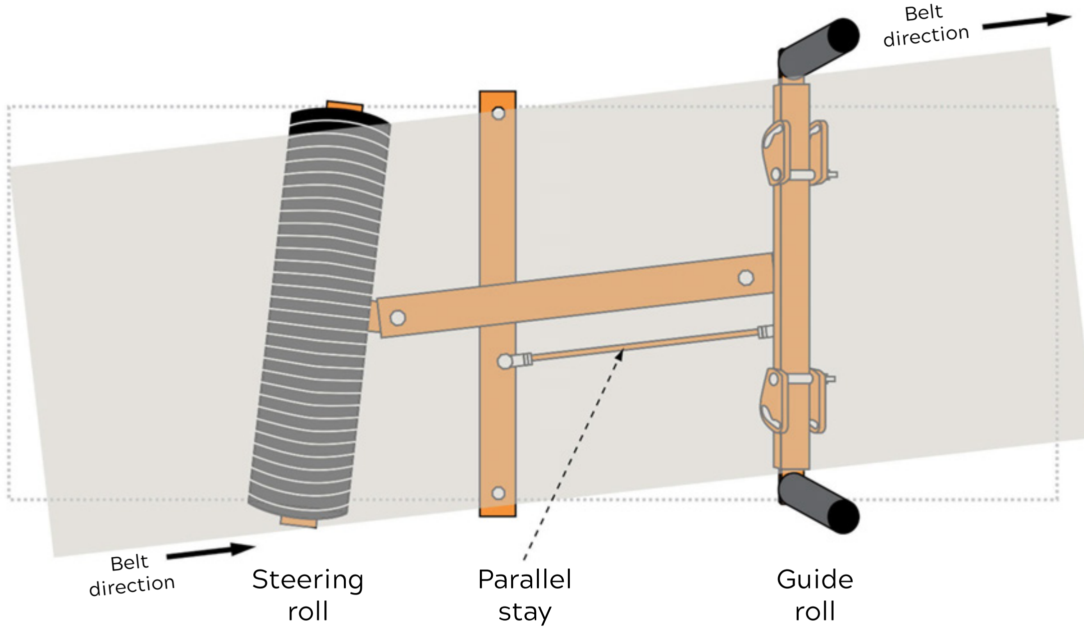
Newer transfer-chute designs aid in centering material onto the belt in a well-sealed environment that maximizes throughput, limits spillage, reduces fugitive dust, and minimizes common workplace injury hazards. Rather than material falling with high impact directly onto the belt, the cargo's descent is controlled to promote belt health and extend the life of the impact bed and idlers by limiting the force of the cargo at the loading zone.

Reduced turbulence is easier on the wear liner and skirting and lowers the chance of fugitive material being caught between the skirt and belt, which can cause friction damage and belt fraying.

Longer and taller than previous designs, modular stilling zones allow cargo time to settle, providing more space and time for air to slow down, so dust settles more completely. Modular designs easily accommodate future capacity modifications.

An external wear liner can be changed from outside of the chute, rather than requiring dangerous chute entry, as in previous designs. Chute covers, with internal dust curtains, control airflow down the length of the chute, allowing dust to agglomerate on the curtains and eventually fall back onto the belt in larger clumps.

Dual skirt-sealing systems have a primary and secondary sealing strip in a two-sided elastomer strip that helps prevent spillage




The pivoting ribbed-roller design grabs the belt and uses the opposing force to shift it back into alignment. *Courtesy Martin Engineering*

and dust from escaping from the sides of the chute.

## RETHINKING BELT CLEANING

Faster belt speeds can also cause higher operating temperatures and increased degradation of belt cleaner blades. Larger volumes of cargo approaching at a high velocity hit primary cleaners with greater force, causing some designs to wear quickly and leading to more carryback and increased spillage and dust.

A solution is heavy-duty engineered polyurethane blades made to order and cut onsite to ensure the freshest and longest-lasting product. Using a twist, spring, or pneumatic tensioner, the primary cleaners are forgiving to the belt and splice but are still highly effective for dislodging carryback.

For the heaviest applications, one primary cleaner design features a matrix of tungsten-carbide scrapers installed diagonally to form a 3D curve around the head pulley. Field service has determined that it typically increases service life by a factor of five, compared with urethane primary cleaners, without needing re-tensioning.

## POWER GENERATION

Systems designed to operate at high speeds over considerable distances are generally powered only at vital locations, such as the head pulley, disregarding adequate power for autonomous "smart systems," sensors, lights, accessories, or other devices along the length of the conveyor. Using auxiliary power can be complicated and costly, requiring transformers, conduits, junction boxes, and oversized cables to accommodate the inevitable voltage drop over long runs.

By attaching a patented mini-generator to idlers and using the kinetic energy created by the moving belt, the accessibility obstacles encountered when powering ancillary systems can be overcome. Designed to be self-contained power stations that are retrofitted onto existing idler support structures, these generators can be employed on virtually any steel roller.

Automation is the way of the future. Conveyor monitoring, tied to safety and predictive maintenance, will become increasingly reliable and widespread, allowing conveyors to autonomously operate and predict maintenance needs. Ultimately, moving large quantities of bulk materials inexpensively and safely will result in the development of many new and higher-capacity semi-automated bulk transfer sites. **EP**

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