chapter 15

Keeping the Belt on Track

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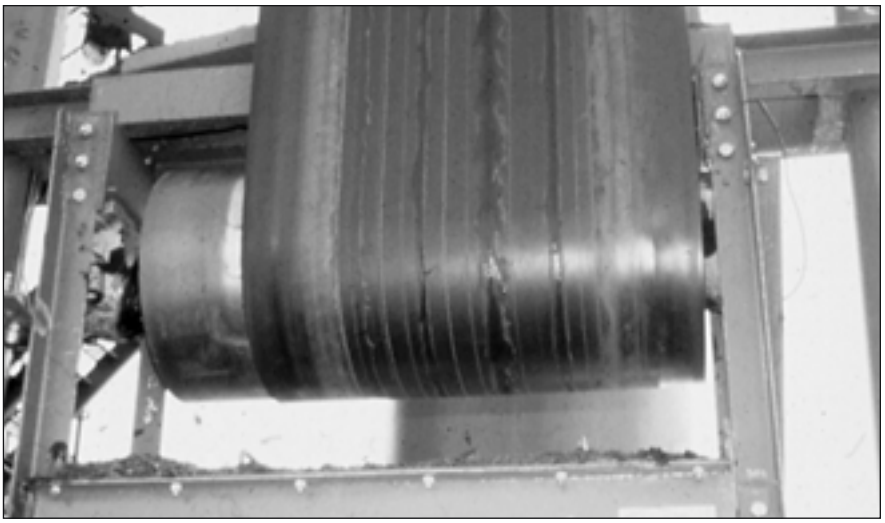

Figure 15.1

Belt mistracking is one of the easiest problems to spot, but one of the more complicated to remedy.

In an ideal world, a sound belt on a well-engineered and maintained conveyor structure should not wander. However, mistracking belts are an everyday fact of life in many bulk material handling operations, and can pose very expensive problems. **(Figure 15.1)** A conveyor that does not run in alignment can cause material spillage, component failure, and suffer costly damage to its belt and structures. Allowing a belt to run to one side of the structure **(Figure 15.2)** can greatly reduce its service life, as it becomes stretched or folds over on itself. Expensive belts can run against steel chutes and structural members to the point where the belts **(Figure 15.3)** and even the steel structures **(Figure 15.4)** are damaged, often beyond repair.

Belts that are hundreds of meters long and cost several hundred dollars per meter can easily represent a total replacement cost of one million dollars. To protect against damage and provide a proper, long-term return on this investment, it is essential to maintain proper belt tracking.

In many ways, proper belt tracking is a precursor to and a fundamental requirement for resolving many of the fugitive material problems discussed in this volume. Belt tracking must be controlled before spillage can be eliminated; if the belt wanders back and forth through the loading zone, material is more readily released under the skirtboard seal on either

(or both) sides. Just as the belt path must be stabilized horizontally through proper belt support and the elimination of wing pulleys, the path must be controlled in the horizontal direction through the elimination of belt wander.

An Avoidable Problem

Mistracking is a system problem. A wandering belt should serve as a flag, signaling there is something more seriously wrong with the conveyor system.

As Clar Cukor noted in the Georgia Duck's monograph *Tracking*,

> [A conveyor belt] is flexible and if designed, manufactured, slit and cut properly, will "go where directed" by the conveyor system as designed and built. The problem of tracking should be approached from a systems point of view. The belt may well be at fault–however, it is more likely merely reacting to a structural defect or maladjustment in the system. The conveyor belt serves as an indicator and should be so regarded.

Wandering belts can be caused by a number of problems. Factors contributing to belt wander include misalignment of conveyor components, off-center loading of cargo, accumulation of fugitive material on rolling components, poor belt splices, structural damage caused by inattentive heavy equipment operators, ground subsidence, and many others. And of course, these problems may be inflicted on the system in any combination, greatly complicating the process of correction.

Figure 15.2

Belts that run to one side of the structure risk expensive edge damage.

Causes of Belt Wander

In many cases, the cause of the mistracking can be determined from the form the mistracking takes. When all portions of a belt run off at a certain part of the conveyor length, the cause is probably in the alignment or leveling of the conveyor structure, idlers, or pulleys in that area. If one or more sections of the belt mistrack at

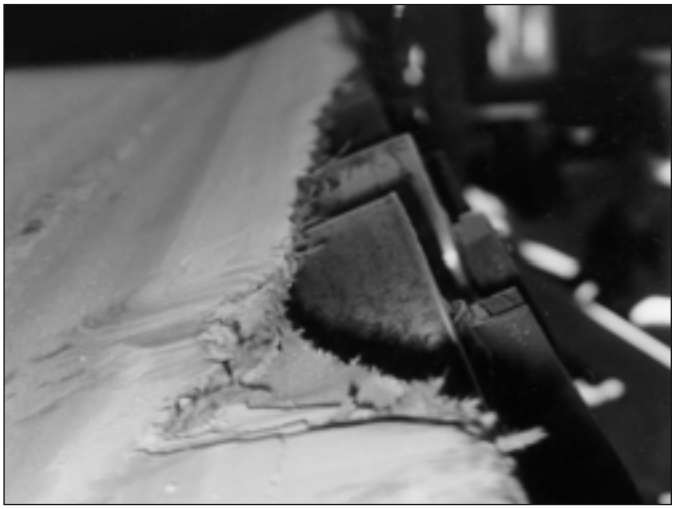

Figure 15.3

This return idler bracket has nearly been cut through by the edge of the mistracking belt.

Figure 15.4

Edge damage resulting from the belt mistracking into the conveyor structure can shorten the belt's service life.

all points along the conveyor, the cause is more likely in the belt construction, in the splice(s), or in the loading of the belt.

Sometimes, a combination of problems will produce belt wander where the cause is not clear-cut. However, if a sufficient number of belt revolutions are observed, the running pattern generally will become clear, and the cause of mistracking disclosed. The usual cases when a pattern does not emerge are those of erratic running from an unloaded belt that does not trough well or a belt that is unevenly loaded.

The most common causes of mistracking can be split into three groups:

1. Faults with the belt:
- the splice is not square to the belt.
- the belt is bowed or cupped.
- the belt has a camber.
- poor installation of vulcanized or mechanical splice.
- defects or damage in the carcass (plys or cords) of the belt.
- top cover damage such as tears or holes.
- different types or thicknesses of belt have been spliced together.
- the belt is poorly matched to the conveyor structure (i.e., the belt's troughability is unsuitable).
- degradation of the belt from exposure to the elements or chemicals.

2. Faults with the conveyor structure:
- the structure was not accurately aligned during its construction.
- idlers and pulleys are not aligned in all three axes.
- material buildup alters the profile of idlers or pulleys.
- idler rolls have seized or been removed.
- the conveyor is subjected to lateral winds.
- the conveyor is subjected to rain or sun on one side or to other adverse environmental conditions.
- the gravity take-up is misaligned.
- the structure has been damaged from collisions with mobile equipment (front-end loaders, haul trucks, etc.).
- the structure has settled on one side through ground subsidence.
- the structure has warped due to a conveyor fire.
- storm damage to structure.

3. Faults with material loading:
- the load is not centered.
- the load is segregated, with larger lumps on one side of the belt.
- intermittent loading on a belt that is tracked for a constant load.

Here are some typical causes of mistracking:

Belt Wander Due To Bad Splices

Improper belt splicing is a significant cause of mistracking. If the belt is not spliced squarely, the belt will wander back and forth on the conveyor structure. This can usually be seen at the tail pulley. The belt will wander the same amount each time the splice reaches the tail pulley, only to return to its original position after passage of the splice. If the splice is bad enough, it can negate all alignment efforts. The solution is to resplice the belt squarely.

Placing a carpenter's square against one side of the belt may not give a true evaluation of the space, as belt sides might not be truly parallel due to faults in its manufacture or slitting. The proper way to splice is to establish a centerline at each belt end, match the centerlines so they form a continuous straight line, and make all square measurements based on that now-shared procedure.

Mistracking Due To Environmental Conditions

Strong winds on one side of the conveyor can provide enough force to move the belt off line. The solution is to enclose the conveyor or at least provide a windbreak on that side. Should rain, ice, or snow be blown in on one side of the conveyor only, then the result will be a difference in friction on the idlers of that side. This difference may be enough to push lightly-loaded belts off the proper path. Even the difference created when the sun warms one side of a belt in the morning and the other side in the afternoon is enough to cause a belt to wander. Here again, the solution would be some form of conveyor cover.

In some cases, the conveyor's design was not sufficiently strong to withstand lateral winds, and the entire conveyor will wander back and forth in high winds. This is especially true on silo or bunker loading conveyors that have straight vertical supports, as opposed to supports built at an angle. In these cases, contact the conveyor designer or a structural engineering firm for recommendations on reinforcing the structure.

Belt Wander Due To Material buildups

Material accumulations on idlers and pulleys **(Figure 15.5)** will lead to mistracking. When wet and/or sticky materials build up, the accumulations simulate components that are out of round or out of alignment. buildup on a rolling component turns that component into a crowned roller. As the belt tries to find this artificial center, it wanders. **(Figure 15.6)** The differing diameter of the accumulations on different components leads to erratic and unpredictable tracking. buildup can also cause an unequal tension on the belt, which is detrimental to the lives of the belt (particularly with steel cord belting) and of the splice.

Special care must be exercised to keep return rolls,

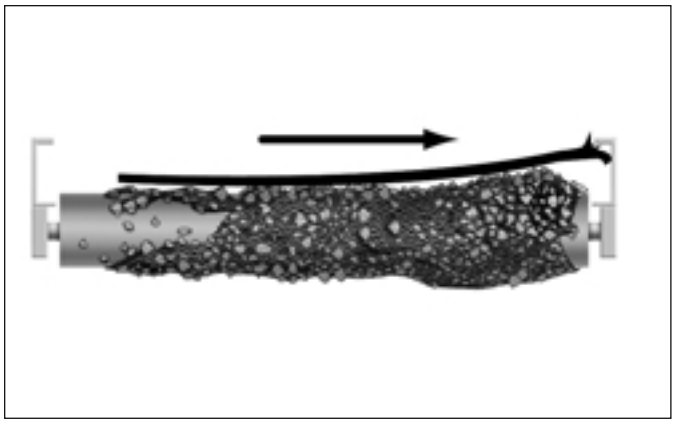

Figure 15.5

Material accumulation on rolling components can lead to belt mistracking.

Figure 15.6

Material remaining on the belt has accumulated on this idler, leading in turn to belt wander.

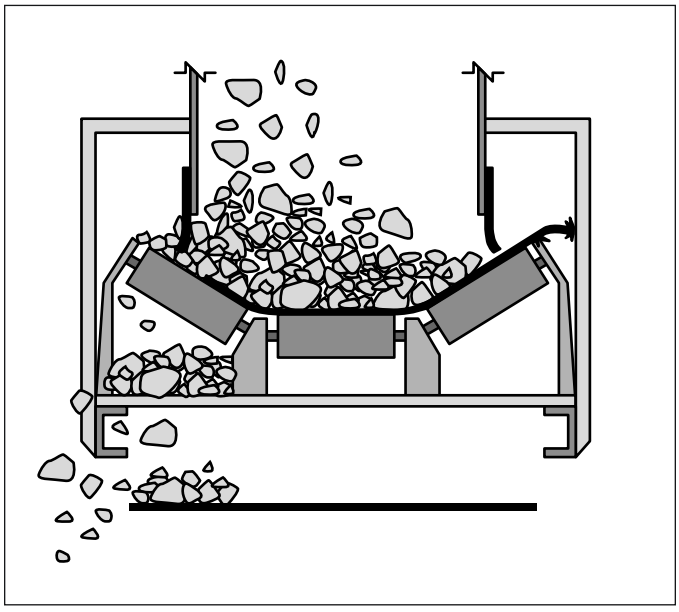

Figure 15.7

Off-center loading can push the belt to the more lightly-loaded side of the conveyor.

snubs, and other pulleys clean. An effective multiple-cleaner belt cleaning system should be installed to prevent material carryback. The transfer points should be engineered, constructed, and maintained to prevent material spillage. If necessary, cleaners can be installed to directly clean snub, take-up, and other pulleys.

Belt Wander from Off-Center or Segregated Loading

Mistracking that arises from loading problems is generally easy to spot, as the belt will run in one position when loaded and another position when unloaded. Of course, this observation may be confused on older conveyors where years of belt training adjustments have altered the natural track of the belt.

If the belt does not receive its load uniformly centered, the load's center of gravity will seek the lowest point of the troughing idlers. This pushes the belt off-center toward the conveyor's more lightly-loaded side. **(Figure 15.7)** This can be corrected by proper loading chute arrangements and the use of adjustable deflectors, grids, and chute bottoms that can be tuned to correct the placement of the load on the belt.

Belt Wander on Reversing Belts

Reversing conveyors, especially older ones or conveyors that run one direction more than the other can be a special source of frustration.

Consider, when a belt is reversed, the tension areas in the belt change location in relation to the drive pulley and loading area(s). Imagine having a conveyor that has a head drive and at the flip of a switch, it becomes a tail drive. When the belt is running toward the drive pulley, the tight side of the belt is on top. When the belt is running away from the drive pulley, the tight side is now on the bottom. This poses some especially difficult problems, as all of the components now contribute differently to the tracking problems. The belt may run fine in one direction and wander all over when reversed, because different sets of rollers and pulleys are controlling belt steering. In order to overcome this type of problem, a survey should be conducted to determine which components are out of alignment and corrections made as required.

Other problems encountered and aggravated by reversing belts relate to off-center loading and different materials on the same belt.

Off center loading can greatly aggravate tracking problems on reversing belts, especially if the load is being applied closer to one end of the conveyor than to the other. This can be corrected by proper loading chute arrangements and the use of adjustable deflectors, grids, and chute bottoms that can be tuned to correct the placement of the load on the belt.

Different materials on the same reversing belt can also cause problems. Suppose the belt has been "tuned" to a specific material with a specific bulk density. Now,

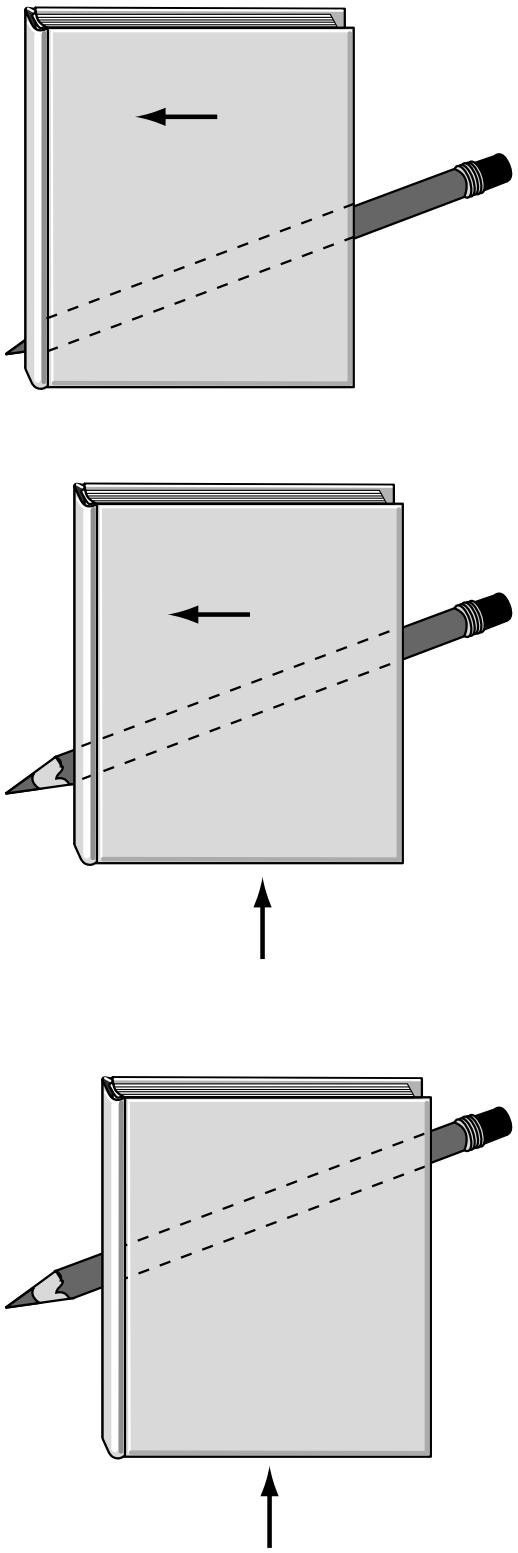

Figure 15.8

The basic rule of belt behavior is that the belt (or book, as demonstrated here) moves toward the side it contacts first.

introduce a material with a different bulk density when the belt is reversed, and all of the training adjustments may go down the drain. Again, in order to overcome this type of problem, a survey of the structure should be conducted to determine which components are out of alignment and corrections made as required.

Basic Belt Behavior

Despite all its various causes, mistracking is still unnecessary. It is a problem that can be controlled or, better yet, corrected. Understanding the basic patterns of belt behavior and undertaking a set of procedures to carefully align the conveyor structure and components and to correct fluctuations in the belt's path can, in most cases, prevent belt wander. This minimizes the expensive problems that accompany mistracking.

Belt behavior is based on simple principles. These principles serve as the guidelines for belt training, the process of adjusting idlers, pulleys, and load conditions to correct any tendency for the belt to run off center.

The fundamental rule of conveyor tracking is simply this: the belt moves toward the end of a roller that it contacts first. If an idler set is installed at an angle across the stringers, the belt will move toward the side it touches first. If one end of the idler is higher than the other, the belt will climb to the high side, because as it lays over the top of the idler, it contacts the higher end first.

This can be demonstrated very simply by laying a round pencil on a flat surface, like a table. If a book is laid across the pencil and gently pushed in a direction away from the experimenter, the book will shift to the left or right depending upon which end of the pencil (idler) the book (belt) contacts first. **(Figure 15.8)**

This basic rule is true for both flat idlers and troughed idler sets. In addition, troughed idlers exert a powerful tracking force. With their troughed configuration, a portion of each belt edge is held aloft at a more-or-less vertical angle. A gravitational force is exerted on that raised portion. If the belt is not centered in the set, the force on the one edge will be greater than the other, pulling the belt into the center of the troughed idler set. This gravitational tracking force is so pronounced that bulk conveyors usually depend upon it as their major tracking influence.

Another constant rule of belt tracking is that the tracking of the belt at any given point is more affected by the idlers and other components upstream (the points it has already passed) than the components downstream (which it has not yet reached). This means where mistracking is visible, the cause is at a point the belt has already passed. Corrective measures should be applied some distance before the point where the belt shows visible mistracking.