INTERNATIONAL MATERIALS HANDLING CONFERENCE

BELTCON 3

Durt, The Movie

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The S.A. Institute of Materials Handling
The S.A. Institution of Mechanical Engineers
The Materials Handling Research Group (University of the Witwatersrand)

DURT™, The Movie

by

R. Todd Swinderman
Vice President and General Manager
Martin Engineering Company

and

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Manager of Research and Development
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"DURT™, The Movie" presents designers and end users of conveyor systems with eight research findings. Summed up, those research findings mean, "Today's technology is capable of controlling dirt in conveyor systems." "DURT™, The Movie" points out the common sources of fugitive material at conveyor transfer points, and demonstrates that incorporating the research findings into conveyor system design will help eliminate the high costs of dirt.

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OUTLINE OF PRESENTATION "DURT, THE MOVIE"

A. INTRODUCTION (5 MINUTES)
   1. MOVIE INTRODUCTION BY MARTIN ENGINEERING
      A. CONCEPT OF MOVIE NON-COMMERCIAL / EDUCATIONAL.
         1. FUGITIVE MATERIALS CAN BE CONTROLLED AT TRANSFER PT
         2. USES CHICKENS TO ILLUSTRATE FUGITIVE MTLS.
         3. POINTS THE FINGER AT ALL OF US.
            A. OWNERS
            B. OPERATORS
            C. SUPPLIERS
            D. ENGINEERS AND CONSULTANTS
         4. MAY MAKE SOME PEOPLE ANGRY / MAKE SOME PEOPLE THINK
         5. SOLUTION IS TO COOPERATE:
            A. REALIZE THE COST OF FUGITIVE MATERIALS.
            B. DESIGN AND OPERATE TO CONTROL DURT.

B. PRESENT THE MOVIE (20 MINUTES)
   1. PRESENTED WITHOUT COMMENT.

C. QUESTION AND ANSWER PERIOD (10 MINUTES)
   1. LEAD QUESTION BY MARTIN ENGINEERING:
      IF YOU'RE SO SMART WHY DON'T YOU RUN OUR PLANTS?
   2. Q&A.

D. CONCLUSION (5 MINUTES)
   1. RESTATE THEMES OF :
      A. CONVEYORS CAN RUN CLEAN.
      B. DURT MUST BE PLANNED FOR IN INITIAL DESIGN.
      C. COOPERATION AMONG THE PARTIES IS A MUST.
      D. CONSIDER COST OVER LIFE OF PLANT NOT JUST CONSTRUCTIO

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You're about to see a research study of one of modern industry's most widely used transportation systems...conveyors. An amazing, high speed, high volume concept that moves millions upon millions of tons of bulk materials everyday...everywhere in the world. Without this dependable and economical innovation, our entire industrial complex would soon grind to a halt.

Perhaps the only other transport concept that is equal in utilization are roadways ... Those intricate patterns of concrete that bisect our cities and span our landscapes. And roadways and conveyors have much in common.

Both are designed to operate smoothly and effortlessly ... handling a large volume of predetermined cargo or traffic.

All works well when operating conditions are well within design limits ... but when unforeseen events occur, anything can happen ...

In the everyday movement of massive amounts of bulk materials, nothing can match the efficiency of high speed conveyor systems.

What makes them so efficient are innovative designs ... incorporating ever wider belts, running over ever longer distances, at faster and faster speeds. This, in turn, made higher tonages routine. The end result was a very significant increase in productivity.

But as designers improved conveyor efficiency over the years, something happened. Industry's most widely used transportation system began to create dirt ... mountains of it. Polluting plants and the surrounding environment ... shortening the life of expensive equipment and frequently creating hazardous working conditions. And strange as it may seem, from the beginning, all

this dirt seemed to be accepted as just another trade-off for progress.

But to some, this dirt was not inevitable. The U. S. Bureau of Mines ... and the British Mechanical Handling Engineer's Association ... and several leading private corporations firmly believe that industry did not have to be burdened with this costly and dangerous menace. To follow their reasoning, let's start at the beginning.

You've heard of "the vicious" cycle? Well, conveyors have one, too.

The vicious cycle starts when owners and designers, in good faith, try to reduce construction costs. Too frequently where conveyors are concerned, attempts at savings are made in the specification of vital equipment. But this initial part of the vicious cycle is often unquestioned ... because many believe that dirt is something we must live with ... and equipment of any kind won't help.

But there's a huge price to pay for this kind of thinking. To better grasp this, let's take a look at a new conveyor system under construction. Here are miles of elaborate fabrications with expensive hardware using thousands of ball bearings ... all with an operating life based on normal industrial atmosphere. However, unanticipated dirt could easily upset the design objectives and production efficiency established for the system.

In a matter of months, this costly investment could be transformed into a major production bottleneck ... literally buried under unnecessary dirt ... dangerous dirt ... causing a chain reaction of expensive operating problems ... like belt

damage ... mistracking ... excessive idler wear ... pollution ... unscheduled production shutdowns ... accidents...even fires! And all can be traced directly back to the unnecessary dirt!

But supposedly, dirt escaping from conveyors is something that we have to live with. It's part of the natural order of things.

Now, new research reveals that nothing could be further from the truth! Conveyors can run clean ... and they should run clean. And there are many excellent examples of clean conveyors ... where owners, operators, designers, and hardware suppliers have worked together to control the vicious cycle.

So it is reasonable to ask ... what makes one conveyor run clean and another dirty? Are there different priorities designers must follow to develop a clean conveyor? Must energy efficiency be compromised to keep a conveyor clean?

Researchers looking for answers started with the root of the problem ... the dirt itself ... or what is technically known as "fugitive material". This encompasses any dust or dirt that escapes from a conveyor ... by spillage ... leakage ... or as "carry-back" on the belt itself.

It can be very fine and dry like powder...or wet, thick and sticky.

To better understand how this dust or dirt evolves, let's examine this simplified drawing of a typical conveyor. Whether it's a mile long or a hundred feet, there's a loading point and a discharge point. A drive section is usually located at the head pulley. A gravity take-up keeps proper tension on the belt. Often there's a cover to protect the cargo from the elements, and a housing to confine the material at each transfer point.

All conveyors have but one purpose ... to move large amounts of cargo quickly and smoothly. If operating conditions are normal, the cargo flows without interruption and relatively dirt free. But if the rapidly moving belt does not track true, if it snakes from one side to the other, great amounts of fugitive materials will spill from the conveyor.

But there's a very dangerous aspect of mistracking ... the possibility of a belt wreck ... destroying an expensive belt ... and endangering operating personnel. To prevent this terrible situation, safety switches are strategically located to shut the system down. And when busy conveyors stop, costs soar immediately.

Research finding number one: Conveyor belts must consistently track true if dirt is to be controlled.

But there's a catch! Designers can readily consult many reference sources to aid in the selection of proper hardware that will make a belt start tracking properly ... but there's almost a vacuum of information on field conditions that physically change conveyor hardware. Changes in dimensions that will severely affect belt tracking.

And there's far too little information on the dirt itself. How it changes in character. And how will these changes affect belt tracking.

There are clues to a solution of this dirt problem in the steps required to realign a belt.

First, the head pulley is aligned with the tail pulley. Next, the snub pulley is aligned. Then, work proceeds on the return side of the belt ... with adjustments made to the return idlers,

the bend pulleys and the rest of the return idlers. It's important to remember that alignment of the underside hardware is the most critical for in-line belt travel.

All of the adjustments needed to realign a belt are usually small ... movements of a fraction of an inch.

In other words, a slight repositioning of hardware affects a belt's tracking. How then, can a belt be kept in alignment if the snub pulley and return idlers keep changing in shape? Changed by the build-up of carry-back dirt. It's a no win situation!

Research finding number two: Carry-back dirt must be eliminated if a belt is to track properly.

But here's another catch! The carry-back dirt itself physically changes. Often becoming sticky ... clinging to the belt ... transported upside down ... deposited on idlers ... hardening in place ... changing the dimensions of these vital components. When this happens, the belt's tracking is affected.

Research finding number three: Carry-back build-up must be eliminated before it builds up on vital components.

But there's a catch! To get this very difficult job done requires a systems approach. The carry-back material must be analyzed under the most adverse conditions the belt will encounter ... even if this occurs only five days per year.

Research finding number four: Design for the most adverse operating conditions ... not what's considered normal.

The reason for this finding is basic. When carry-back dirt is

allowed to "overpower" the cleaning system, the conveyor becomes inefficient ... and a dangerous dirt producer. Then costly man-hours must be devoted to cleaning up the mess around work areas. And operating life of expensive components is shortened ... as dirt erodes their vital parts.

When dirt wins, the problems go on ... and on ... and on!

With belts becoming wider and faster, one cleaner can't be expected to remove all of the carry-back: A multiple cleaner system is required if a high speed conveyor is to be kept reasonably clean.

Research finding number five: Conveyor systems must be designed with multiple cleaners.

But there's a catch! Far too many conveyors, properly equipped with multiple cleaners, lose the battle to dirt because space was not provided to maintain the cleaning equipment. There are many examples of this costly oversight.

Compare these designs to ones with a "system approach" to belt cleaning. A multiple system ... effectively removing all of the carry-back material as far forward on the head pulley as possible to avoid build-up on the dribble chute. And most importantly, a system designed with adequate room for service and maintenance.

One of the most popular head frame designs uses a standard horizontal structural shape. All too frequently, little or no space is allocated to install ... much less service ... an effective belt cleaning system. Without maintenance, the best of belt cleaners soon become useless.

Without increasing construction costs, this same area can be easily designed for proper cleaner maintenance. It can be accomplished with a custom designed horizontal support ... or a vertical bearing support. Either application will provide adequate installation space for multiple cleaners ... and room for maintenance people to service the equipment to keep it functioning efficiently. The best equipment in the world needs routine maintenance and cleaners are no different.

Now, let's examine the other end of a conveyor ... the loading point. Dirt escaping here can also be traced to sincere attempts to keep construction costs down. Such things as loading too close to the tail pulley ... hoping to shorten conveyor lengths and satisfy space restrictions. Too few idlers in the loading area. A minimal amount of skirting ...

All of these things may keep costs down in construction ... but usually result in great quantities of dirt.

Research finding number six: Properly designed loading areas are essential to dirt control.

But there's a catch ... the material will change in character. Falling onto the belt it is turbulent ... and becomes aerated ... consequently occupying more space.

In the first six to eight feet of travel, this cargo may be piled twice as high as normal above the belt ... and be riding against the wearliners. The position and shape of the wearliners will determine how effective the rubber skirt will be.

To be dirt free, a loading point must take into consideration these design factors. Adequate space between tail pulley and the loading hopper ... idlers closely spaced to maintain a flat belt profile ... rubber skirting of sufficient length ... dust pick-ups ... and access doors for easy interior service.

However, the important aspect to control dirt at loading points is often overlooked. The loading itself must be done in the center of the belt ... because off-center loading causes serious belt misalignment ... and as we've seen, belts not tracking true are major dirt producers.

But center loading is difficult and sometimes even impossible because of the changing trajectories of the cargo as it is loaded.

Research finding number seven: Conveyor belts can be contoured to compensate for off-center loading.

By steepening the sides of the belt ... and adding mechanical shaking ... gravity will force the cargo back to the center ... sending it on its way in proper alignment.

Research Summary:

Today's technology, if conscientiously applied ... is capable of controlling dirt in high speed conveyor systems.

This finding is stated conclusively in published studies by the U. S. Bureau of Mines and the British Coal Board.

But there's another catch! Unless this knowledge is incorporated into conveyor designs as "a must" priority ... and unless

adequate maintenance is accomplished ... dirt problems will continue to cost millions of dollars yearly.

Dirt can be controlled!

Thinking clean is the first step.