Technology for the Belt Conveyor and Bulk Material Handling Industries

Overland Conveyor Co., Inc.

… *Corporate Overview*

Mission Statement

Overland Conveyor Co., Inc. is an association of belt conveyor professionals dedicated to excellence in Belt Conveyor Design, Engineering, Installation, Maintenance and Troubleshooting using an integrated systems approach.

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OVERLAND CONVEYOR COMPANY, INC.

We're on the Web at: http://overlandconveyor.com

Mark A. Alspaugh

When all is said and done, our prime goal is provide each client with sound engineering and the best information available in order to make the right decisions.

And we always strive to provide more than expected...

To fulfill our mission:

1. We will encourage long-term relationships with mining companies who rely on belt conveyors to transport bulk materials. The goals of these companies are to mine raw materials at the lowest cost possible, which requires economic and reliable bulk material handling. Our services will consist of operations driven, system integration of conveyor components through advanced system modeling and simulation, performance monitoring and preventive maintenance.
2. We will solicit strategic alliances with non-competing component manufacturers and service providers who rely on belt conveyor users for the majority of their sales, manufacturing or service, These companies will represent industry leaders or potential industry leaders in their respective fields who are looking for ways to add value to their components or services through a strong industry reputation of technically superior service. The ability to integrate components into a reliable system is essential to trouble free operation.
3. We will establish links to research organizations and Universities with active research or academic programs complimenting our goals. These links will give us access to the latest and best mathematical modeling algorithms and theoretical problem solving expertise.
4. We will take a leadership role in industry technical organizations with material handling divisions or interests and will publish internationally to highlight the technical leadership of our organization or to emphasize the technical superiority of our strategic partners.

Belt Conveyor Design / Engineering Capabilities…

Component Design / Performance Evaluation
- Mathematical Modeling
- Finite Element Modeling
- Discrete Element Modeling

System Modeling, Design and Engineering
- Conceptual Design
- Route Optimization
- Static Design
- Dynamic Stopping and Starting
- Horizontal Curves
- Transfer / Mass Flow
- Controls

Specifications
- Performance
- Conveyor Systems
- Conveyor Components

Design Audits
- Material Handling Systems
- Conveyor Systems
- Conveyor Components

Field Services
- Troubleshooting
- Failure Analysis
- Steel Belt Non-Destructive Testing
- Data Collection
- Equipment Performance Audits
- Splice Supervision, Failure Analysis

Custom Software Design
- Systems
- Components
- AutoCAD 2D and 3D
- Solid Modeling
- Finite Element

Advanced Analysis… the key to robust design

Edmond O'Donovan

using… Static Methods

Static analysis of belt conveyors is performed to size and locate all components. This rigid body analytical technique is used to quickly review many operating conditions including high and low friction conditions and all critical load cases. We also use static analysis to quickly compare component locations on new applications to optimize performance. When required, we use existing components as specified by the client. From static modeling, we are be able to determine worst case load conditions for running, stopping and starting and generally evaluate the performance of all components.

using… Dynamic Methods

Dynamic analysis is used to test and refine the starting and stopping control algorithms or requirements. Dynamic Analysis is a time based analytical technique which utilizes Finite Element Methods We perform this analysis on stopping and starting conditions where the elasticity of the belt can create transients in belt speed, belt tensions etc. The results of the static models are used as inputs for this phase. The actual time required to perform this analysis will vary widely based on the complexity of the conveyor, the complexity of the control algorithms to be tested and the specific drive components being reviewed.

using… Finite Element Methods

The finite element method is a numerical method for solving a system of governing equations over the domain of a continuous physical system. This method is applied to many fields of science and engineering to solve complex physical problems.

We use the finite element method to evaluate specific stresses and strains on belt conveyor components once the macro loads have been determined from the static and dynamic computer models.

using… Discrete Element Methods

DEMs are a family of numerical modeling techniques specifically designed to solve problems in engineering and applied science that exhibit gross discontinuous mechanical behavior. One specific example of a geo-engineering problem dominated by discontinuum behavior is the flow of bulk solids in hoppers, chutes between conveyor systems.

The DEM explicitly models the dynamic motion and mechanical interactions of each body or particle in the physical problem throughout a simulation and provides a detailed description of the positions, velocities, and forces acting on each body or particle at discrete points in time, called time steps, during the analysis.

In the transfer point DEM model, lumps of bulk material are simulated with a system of spherical shaped bodies. The bodies can interact with other bodies, with the chute surfaces, and with moving the conveyor belt surface.

Specifying the input/output and boundary conditions with a discrete element model is different than other numerical techniques such as finite elements. For the transfer point simulation several physical situations must be modeled. The material properties are defined with contact parameters. The geometry of the transfer station is specified with boundaries in the DEM. The material must be loaded onto the incoming belt and taken off the exiting belt.

Perhaps the greatest benefit that can be derived from the use of these analysis tools is the "feeling" an experienced conveyor designer can develop for a conveyor as a flexible arrangement of many interacting components. From this feel, the designer can from the very beginning of the design process, arrange the system so as to minimize or eliminate unwanted dynamic effects, thereby producing a more reliable and robust conveyor system.

Training and Education…

E. A. "Bud" Viren

We believe strongly in training. The more engineers, operators and maintenance crews understand the general behavior of belt conveyors, the easier it will be to identify and head off potential problems.

But belt conveyors are uniquely difficult to understand for 3 reasons.

1 A conveyor is a huge machine which can stretch for miles. The behavior of a component at one end may dictate an undesirable condition at the other end. Since it is impossible for one person to be in remote locations at the same time, connecting the undesirable condition with the source of the condition can be difficult.

2 Each conveyor is unique. Although they all move bulk materials from point A to point B, these points will never be the same twice and the terrain in between is infinitely variable. A good design or solution on one conveyor may produce just the opposite results on another conveyor. Every belt conveyor is a prototype.

3 Multiple components from multiple manufacturers utilizing multiple engineering disciplines makes it very difficult for any single person to be knowledgeable or stay knowledgeable on every system..

As such we constantly organize industry educational and technology sharing events in conjunction with the industry organizations and universities. We also develop and conduct on site, customized training session from 1 day to 1 week long.

Our approach to training is not the traditional approach of listing do's and don'ts, but of providing an understanding of how conveyors work. These cause and effect relationships are much easier to see and understand through demonstrations utilizing sophisticated computer graphics. Modern interactive programs which provide immediate feedback allows the trainer to simulate a system change and see the impact on

Conveyor Reliability…

Conveyance equipment which fails to achieve its performance requirements or projected life due to undetected problems may require expensive repair or early replacement. Some problems may lead to unforeseen breakdowns and production interruptions as well. Equipment repair and production loss both mean loss of revenue to the owner.

The term most often used to describe the above is equipment Reliability. Reliability is defined as the probability that equipment will perform for a desired period of time during which it is subjected to a given set of environmental conditions and mechanical stresses. Taken together, the performance criteria, desired lifetime and expected stresses define the intended application of the equipment. Thus, reliability is a function of the application of the equipment.

Every belt conveyor is unique and therefore reliability will be different for every application. The biggest difficulty in achieving high reliability is in combining component knowledge with application knowledge. Manufacturers may not fully understand every application and operators do not fully understand the interaction between individual components and the mechanical stresses of their applications. If problems exist, they generally are not uncovered until something fails.

Overland Conveyor offers an integrated approach to predicting problems and increasing conveyor reliability. Our *Conveyor Reliability Examination* combines system design analysis and Non-Destructive Evaluation (NDE) to provide a complete analysis of specific applications. Not all failures are predictable, but we're working on it.