Summary

Energy efficiency is becoming important in the bulk handling industry. The two main reasons are the desire to reduce one's carbon footprint and cost savings. Research conducted by Hiltermann [1] on belt conveyors indicates that significant power savings can be realized by implementing speed control on belt conveyors.

This research will develop a model to be able to simulated energy consumption and savings of belt conveyor system of 'nominal' (fixed speed) operation and speed controlled operation.

A literature research has given insight into the current design theories and models of speed control and trough belt conveyor systems. An overview is given of the different calculation methods of motional resistance of belt conveyor systems, important for determining the power needed for operation. It seems that DIN 22101 [9] based motional resistance models deliver an accurate prediction of the motional resistance of a generic belt conveyor under the relevant operating conditions.

After acquiring the theoretical knowledge, the simulation model design is described. The system requirements are first described in terms of model output, performance indicators and model input. The performance indicators are the same as the numerical output of the model; Total bulk material transferred(Million Tons), total costs of power consumption nominal operation (Euro), total costs of power consumption speed control operation (Euro) and total savings by speed control (%). Next, the outline of the model is basically described in the conceptual model which is the first step of implementation. The second step is a more in-depth description of the model, in so called Process Description Language (PDL).

To build the model, the system description is translated into Pascal language in the Delphi environment. A graphical user interface is created to assist the user to provide the required input for the model. Next, the model has to be verified, every element of the model is verified by a different tests.

In order to significant results a plan has been made which produces input parameter sets for three different input types for fifteen simulation runs. The different performance scenarios are defined as the nominal belt speed, the size of the bulk terminal (nominal loading) and the kind of distribution of the loading (production rate). Further, the minimal runtime for valid results is determined and set to one year of operation.

After execution of the simulation runs it can be concluded that the built model is a proper model to show possible energy savings. The model describes the trends of savings at the different performance scenarios. However, the individual results cannot be used as data to draw conclusion as the value of possible savings of the belt conveyor system using speed controlled operation instead of nominal fixed speed operation. It is therefore advised to optimize the simulation model presented in this report, to gain more significant results.