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Conveyor belts - predictive maintenance

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Conveyor belts and their maintenance make a significant cost item in the sectors of mineral extraction and processing and energy. Deloitte, thanks to a combination of industrial maintenance expertise and an advanced data analytics team, has developed a unique solution in the field of predictive maintenance of conveyor belts. The solution was verified by a pilot project.

For the purposes of the pilot project, we identified a belt conveyor of our client, which on the one hand lies on the critical supply route of key raw material and its performance is not backed up. In the event of its failure, it is therefore a major reduction in the production of the entire company. As part of the pilot project, we used the data from the installed “Schenck” belt weigher, as well as the measurement of the current load of the drive in the client's substation, and we carried out the data transmission using IoT SigFox.

The principle of the solution is an online monitoring and continuous evaluation of the dependence of two basic parameters of conveyor belts, which are, on the one hand, the aggregate weight of the transported raw material and also the instantaneous current load of the belt conveyor drive.

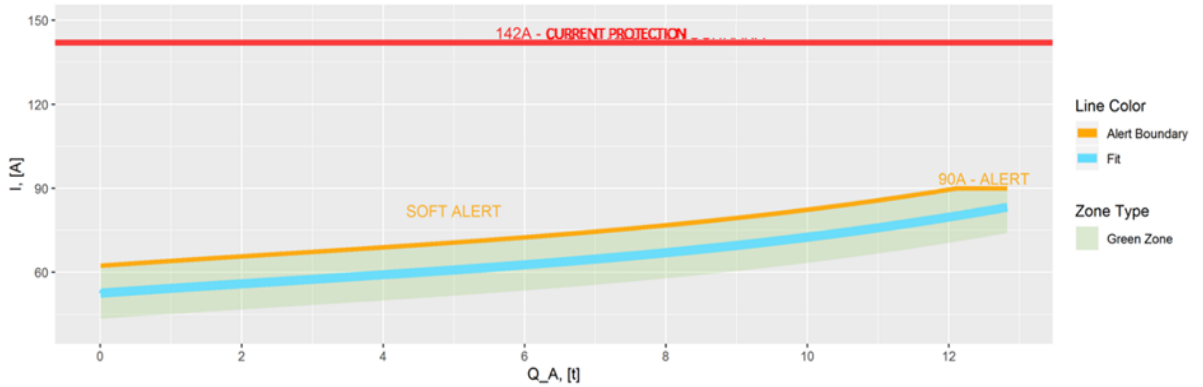

Fig. 1. Dependence of the current load on the aggregate weight

Fig. 1 shows the optimal dependence (blue) of the weight of the transported material and the current load. The green field includes 99% of the measured values during the weekly operation of the belt in optimal condition. The yellow curve represents the limit of optimal operation. Crossing the yellow border indicates an anomaly that will lead to failure.

The principle of the solution is that the system is able to identify and alert the operator to a non-standard development of the independence of the current load on the aggregate weight of the transported raw material before damage to the belt or steel structure of the conveyor or backfill occur or, as the case may be, before the conveyor is shut down by the intervention of current protection.

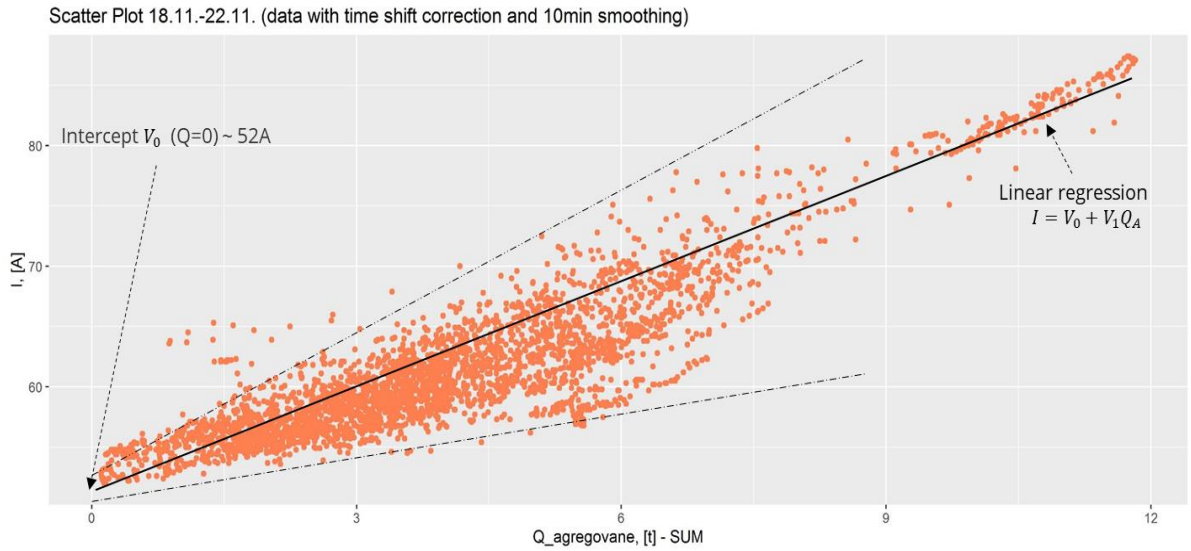

Fig. 2. Intercept and slope - theory

In addition to the basic dependence between the aggregated mass, it is appropriate to observe the intercept - ie the place where the linear regression line intersects the y-axis and also the slope - ie the slope of the linear regression line, see Fig. 2.

Fig. 3. Intercept and slope in a robust linear model estimated within a four-hour sliding window

The graphs in Fig. 3 show the results of monitoring the intercept and slope of linear regression of the aggregate mass and current load - linear regression in a 4-hour sliding window. Both quantities show a relatively high correlation rate - 66%. The marked places correlate with the detected damage to the belt conveyor.

The solution benefit is the estimated savings in maintenance costs in the following areas:

- Rollers and cylinders - longer service life - approx. 20-40%
- Conveyor belt - approx. 40-60%
- Steel structure, slips, shifters, side guides and wiper blades – approx. 30-50%
- Drive, transmission - about 20%

Another, no less significant effect is the possibility of reducing the frequency of preventive inspections, which leads to FTE savings, and the advantage is also the elimination of unplanned conveyor outages.