

Using Predictive Maintenance Safety on Conveyors



CEMA BULK BELT SYSTEMS AND EMERGING TECHNOLOGIES COMMITTEE

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Predictive Maintenance (PdM), also known as Condition Based Maintenance (CBM), is well known¹ to reduce costs and improve machinery and plant reliability and availability by reducing the need for corrective or reactive maintenance and avoiding unplanned downtime. It is also well known^{2,3} that PdM improves worker safety in industry, including mining and quarrying by reducing the need for maintenance repairs. The PdM program can use a number of different detection techniques / technologies depending on the asset type and operating conditions. The most common PdM technologies used on conveyors is vibration analysis followed by lubrication analysis and thermography. Vibration analysis can be applied to the conveyor pulleys—head, tail, bend and take-up, and the gear drives and motors.

The vibration analysis must be properly implemented to be done safely. Vibration monitoring can be done with a portable vibration data collector with either a “portable” sensor or permanent mounted sensors. Vibration monitoring can also be made on a continuous basis using permanent mounted sensors and monitored by either a vibration transmitter or on-line system. The output of the vibration transmitter can be connected to the plant automation for monitoring. Portable data collectors and on- line systems are then evaluated by a vibration analyst.

Portable sensors, usually sensors attached to a magnetic base, can only be safely used if they can be attached to the conveyor pulley bearing housing or driveline outside of any guarding. Usually the guarding prohibits temporary attachment of the portable sensor. Good safety practices and regulation (MSHA in USA) prohibit reaching around the guarding. Cases have been seen where the guarding is inappropriately modified to allow access to the pulley bearing housings.

See Figure 1.

The safest technique for vibration monitoring on conveyors is to use permanent mounted sensors fastened to the conveyor pulley bearing housing, gear drive and motor, and the sensor cables routed outside the protective guarding. Permanent mounted sensor should have a low profile with side exit cable. The cable should be integral with the sensor body and have a steel over braiding. **See Figure 2.** These features are needed to ensure the reliability of the sensors and cables and ensure the sensors themselves don't become maintenance items. The sensor cables are routed to a common enclosure with BNC type connectors that the portable vibration data collector can connect to, or to a common enclosure for wiring to the vibration transmitter or on-line system. Permanent mounted sensors, besides being used where the conveyor has guarding, can also be used where the conveyor is elevated or has risky access, thus helping avoid worker exposure to hazards.⁴



Figure 1. Inappropriate modification of guarding



Figure 2. Vibration / temperature sensor designed specifically for mining, mineral processing and cement

The maximum distance between the sensor on the conveyor and the BNC enclosure for portable data collection is 30m (98 feet). Permanent mounted sensors and portable vibration data collectors used in underground coal mines must have local regulatory (MSHA in USA) approval.

Sound monitoring of the conveyor idler rollers using a portable data collector can also be applied as an objective means to detect failing idlers. This can help detect a failing idler earlier than might be detected by the human ear, thus avoiding the risk of a seized idler that might damage the belt, requiring potentially hazardous repairs or fire.

¹ Making maintenance smarter Predictive maintenance and the digital supply network. Chris Coleman, Satish Damodaran, Mahesh Chandramouli, Ed Deuel, May 09, 2017, Deloitte University Press.

² Predictive Maintenance: Marrying Safety With Productivity. <https://www.mbtmag.com/article/2016/12/predictive-maintenance-marrying-safety-productivity>

³ How predictive maintenance can improve worker safety in dangerous industries. <http://www.genessolutions.com/how-predictive-maintenance-can-improve-worker-safety-in-dangerous-industries>

⁴ For More Operation, Maintenance, and Safety information see the 7th ed. Belt Conveyors for Bulk Materials