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## ENGINEERING ANALYSIS TO LAGGING PERFORMANCE

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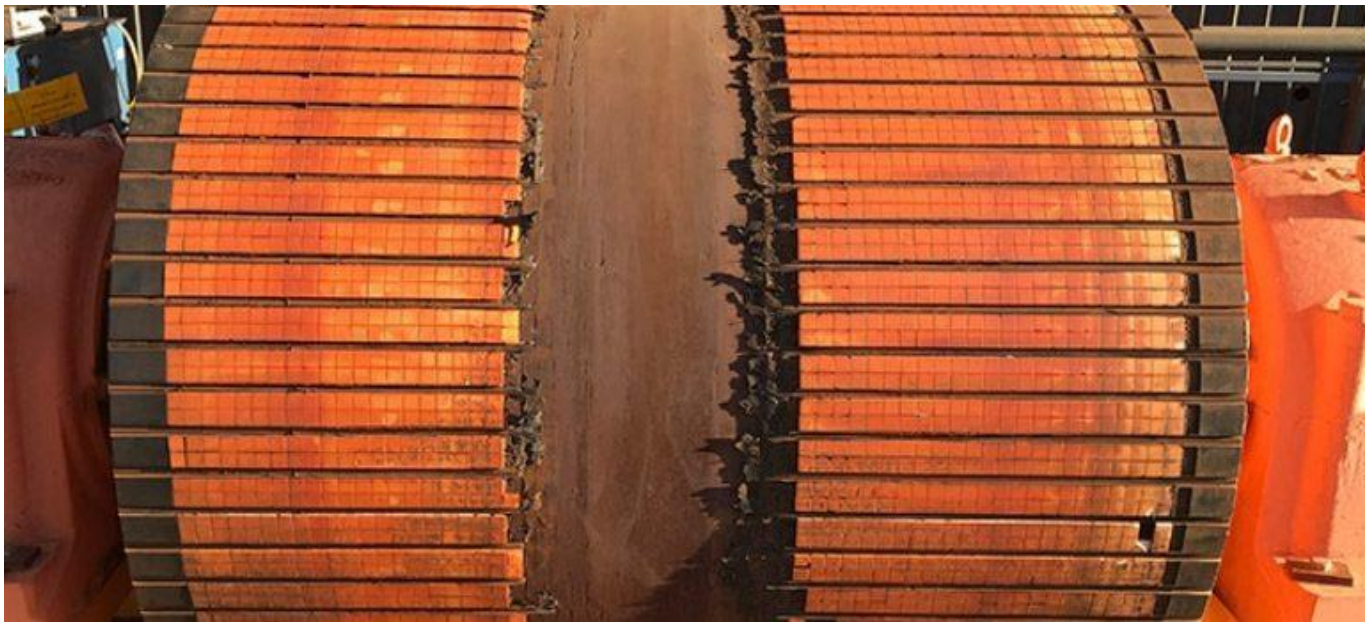

# Engineering analysis to lagging performance

A Elastotec, a specialist in pulley lagging, has partnered with TUNRA Bulk Solids and the University of Newcastle to better understand how close to the fatigue limit lagging is operating

As conveyor designers work to increase capacity, the demand for more power transfer has also increased.

This can be seen in high-performance gearless drive conveyors, where drive power has increased steadily from 3MW to 6MW, with some engineers even planning to move to 10MW drives.

This power transfer is done through the pulley lagging and while the technology has developed, engineers do not entirely know how the stresses develop in the interphase. There is limited understanding of friction limits between both surfaces and how the different operating conditions affect the distribution of the stresses.

There are recurrent lagging failures in the field mainly on drive pulleys and non-drive High Tension Bend pulleys. These two pulley types have the highest concentration of shear stresses. Drive pulleys have high localised shear stresses due to the difference in incoming and outgoing tension of the belt. High tension bend pulleys due to uneven tension along the face width due to belt cover wear and carry back. These high concentrations of stresses come not only from design but also from changes in operating conditions.

Stresses at the interphase are cyclic. Pulley lagging operates in a dynamic application where a load is applied in a normal direction and in a shear direction to the lagging and is then removed each time the pulley goes through one revolution. This causes deterioration of the lagging when the lagging fatigue limit is reached and adhesion of the lagging to the pulley shell resulting in failures that affect conveyor availability.

Operating conditions than can affect the distribution of stresses:

- Ageing of compounds
- Wear of belt cover and or pulley lagging
- Build up between pulley lagging and belt
- Uneven pulley TIR
- Uneven flatness of belt cover in contact with lagging
- Uneven lagging geometry due to ceramic lagging tile loss.
- Belt misalignment
- Uneven load sharing on dual drive

Conveyor designers want to know the limits of power transfer that pulley lagging can handle and the service life at which pulleys can perform reliably under these increased loads and different operating conditions. Currently, the fatigue limits are unknown for:

- pulley lagging bonding systems to pulley shell
- pulley lagging intrinsic fatigue limits

Behaviour of the interphase has an impact on pulley service life but more important, on the conveyor belt life, which is one of the most expensive components of any conveyor.

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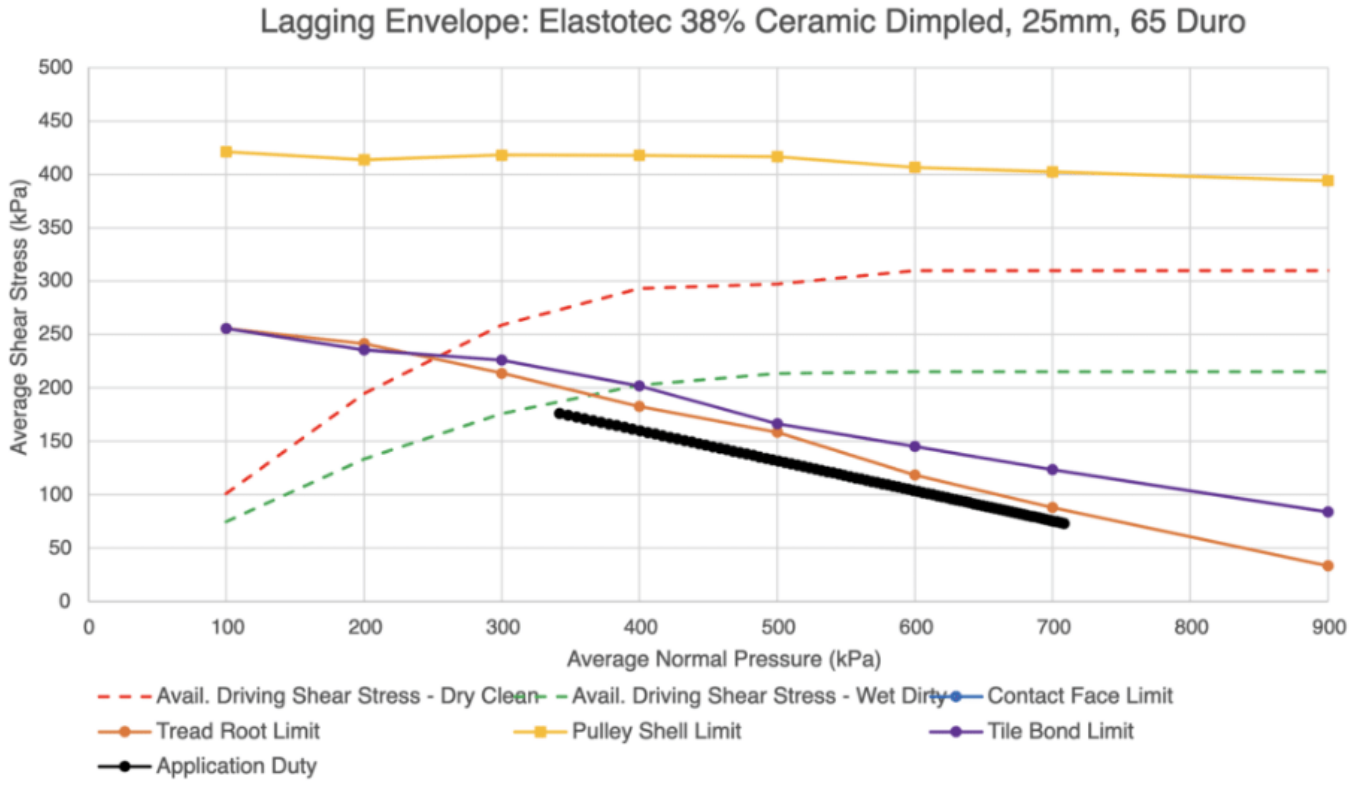
Examples of this are:

- Localised slippage on drive pulleys causing belt cover damage
- Belt cords differential radius along face width on high tension bend pulleys due to lagging wear, belt cover wear or carry back causing premature belt splice failure and cord damage in the main body of the belt.

The combination of the cyclic shear stresses developed and the lagging fatigue life when exposed to these stresses will determine the limits of the lagging capability to perform. Understanding these limits will provide engineering companies with solid and reliable input information when designing conveyors or dealing with pulley lagging premature failures.




Elastotec is a global pulley lagging specialist committed to providing long lasting solutions to the mining industry. The company has embarked in a five-year research and development project in conjunction with TUNRA Bulk Solids and the University of Newcastle to understand what happens at the interphase between lagging and belt and provide the engineering support required for lagging selection that ensures performance.

The end goal of the project is the development of a Lagging Selection and Lagging Performance software tool that provides provide the engineering analysis to ensure performance of lagging selection.

Once this tool is developed using theoretical modelling and Finite Element Analysis (FEA), in collaboration with conveyor design specialists Overland conveyor and Conveyor Dynamics, the next step will be to calibrate every aspect of the tool to precisely understand what happens in the conveyor.

This will require lab testing, characterising of the rubber compounds with Edurica as a partner, testing bind systems fatigue limits, and lagging friction limits. Following this, a test rig will be designed and built-in conjunction with TUNRA.

The rig will test new and worn belts with a 400 to 4000 kN/m rating, with a drive pulley of 1500mm and a belt width of up to 1200mm. It will feature an interchangeable pulley lagging surface, and test the dynamic fatigue of the belt splices with nominal breaking forces between 3500 to 6500 kN/m with the installed pulleys.

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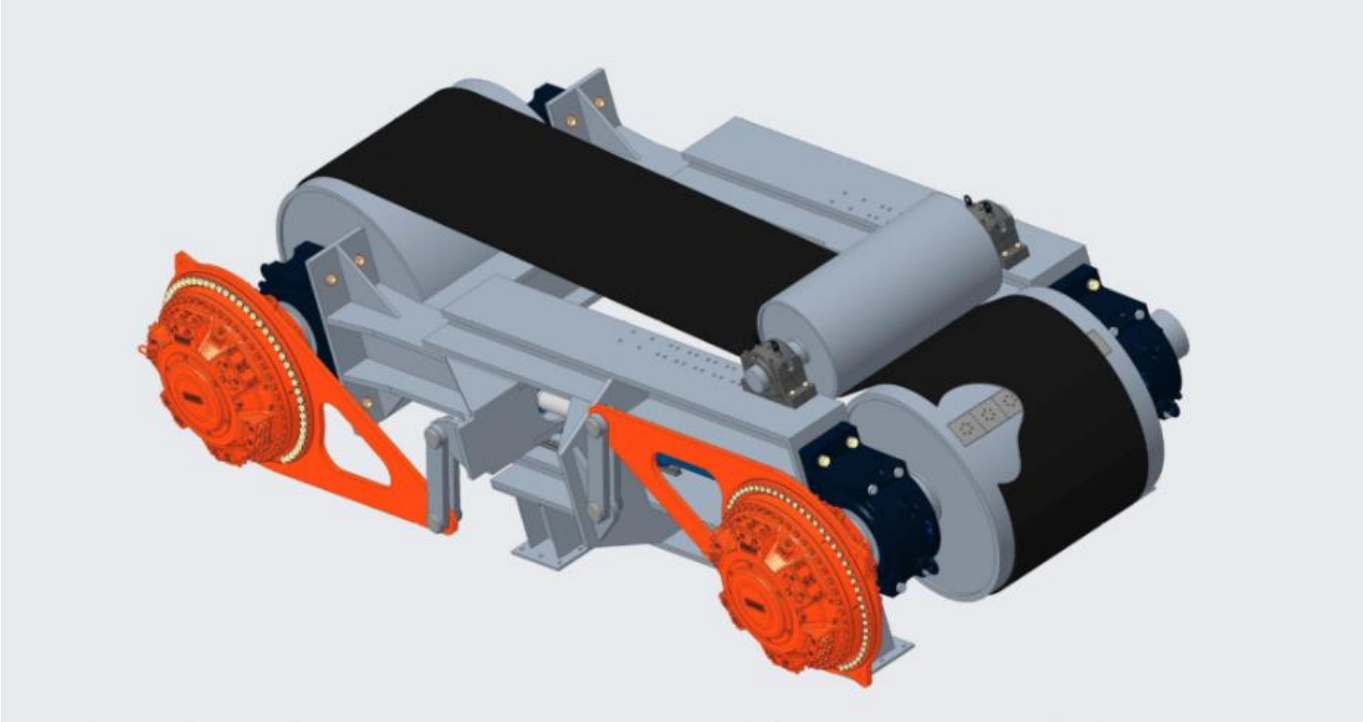

THE FRICTION RIG WILL TEST NEW AND WORN BELTS WITH A 400 TO 4000 KN/M RATING.

Multi-axis load cells will be installed axially along the pulley face under the lagging shell to measure the force acting on the lagging surface.

The last step of validation will see a pulley with sensors installed in the field to gather real world data.

Mariana Ballestrin, pulley lagging business development manager at Elastotec, said pulley lagging is currently selected based on historical information.

*"There is no engineering analysis to help determine if the lagging will tolerate the stresses developed at the interphase of the lagging and belt," Ballestrin said.*

*"In many cases, pulleys fail due to lagging. Conveyors need to stop due to lagging failures. The consequence of this is loss in production output. There's a need for a different approach.*

*"Lagging is not a consumable. Lagging designed and engineered to perform lasts as long as the mechanical components of the pulley eliminating failures due to pulley lagging and increasing production output."*

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