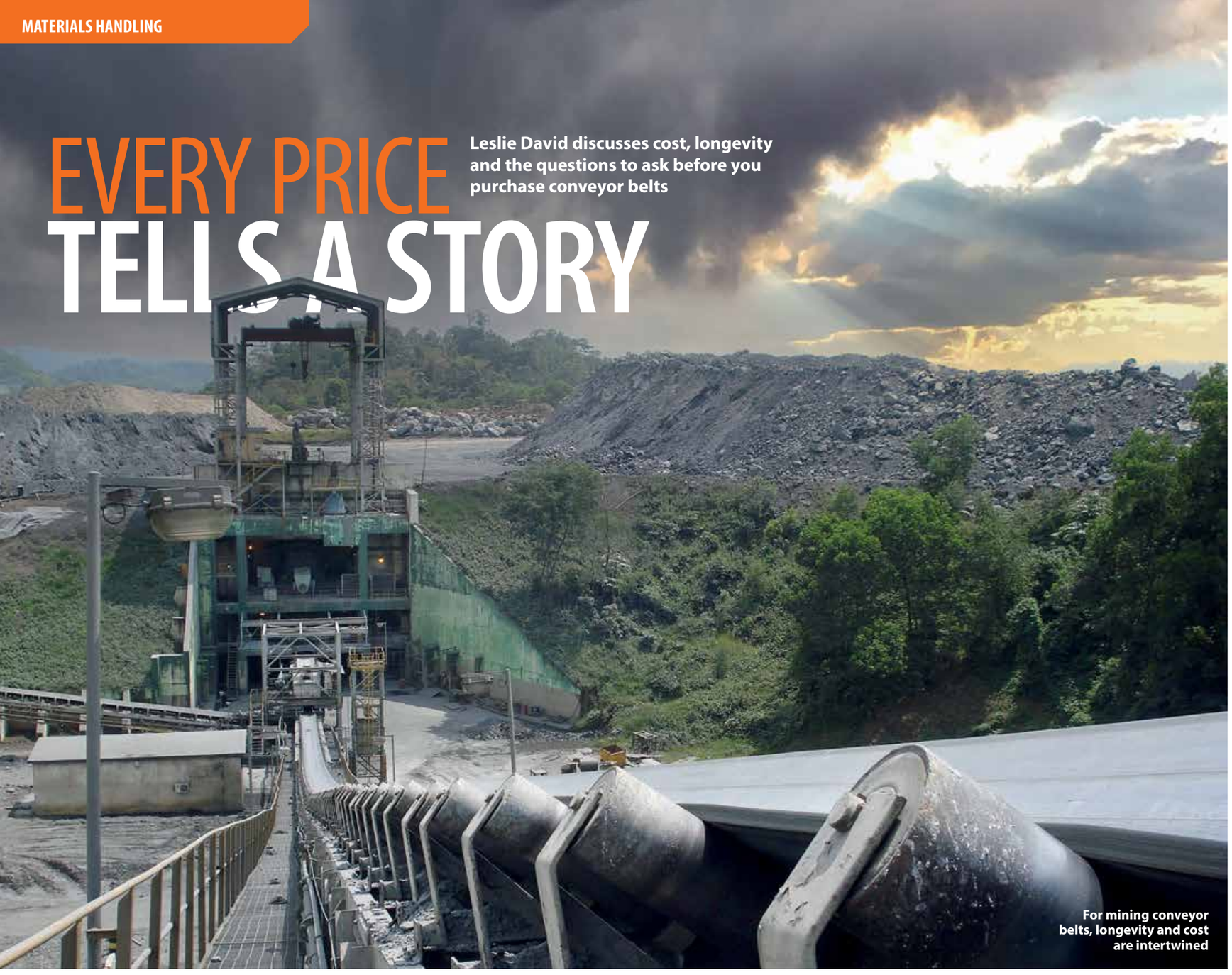
EVERY PRICE TELLS A STORY

Leslie David discusses cost, longevity and the questions to ask before you purchase conveyor belts



For mining conveyor belts, longevity and cost are intertwined

Analysis of internet search engines reveals that the two most commonly asked questions concerning rubber conveyor belts are "how long should they last?" and "how much do they cost?". Ironically, the answers to both questions are inextricably linked. Here, we explain how and why.

HOW LONG SHOULD CONVEYOR BELTS LAST?

The service life of any conveyor belt is determined by two basic factors. Firstly, it is the overall quality of the belt, its physical properties and ability of the belt to handle both the material it is required to carry and the local working environment. The second biggest influencing factor is the type of materials being carried. In the past, the type of material was considered to be the primary influence. However, this was before the technological advances made by manufacturers such as Dunlop Conveyor Belting in the Netherlands (Fenner Dunlop), which is part of the Michelin Group, and Contitech in Germany.

Regardless of which takes precedence, the inarguable fact is that both factors are inextricably linked. The reason for this is that the true cost of a conveyor belt can only ever be measured and compared based on its purchase price, fitting and cumulative repair costs divided either by its working lifespan or the tonnage carried during that time.

As with any manufactured product, price ultimately determines the quality and the longevity. In the world of conveyor belts, it is not uncommon to see 'economy' belts being offered, usually by manufacturers based in Southeast Asia, at literally half the price of those being offered by the big, quality-led manufacturers based in Europe. However, a big difference in price invariably indicates a comparable difference in the quality of the materials used. The materials used to make a conveyor belt can constitute up to 70% of its ultimate cost and are therefore the prime target for cost-cutting for those wishing to offer lower prices than their competitors. To better understand the connection between the sales price, longevity and the effect on whole life cost, it is necessary to understand the methods used to minimise the selling price and their negative impact on the performance and length of operational life.

IT'S ALL ABOUT THE RUBBER

It is the quality of the outer rubber covers, in particular the ability to resist wear and tear, that has the biggest influence on the operational lifetime of a conveyor belt. Rubber usually forms some 75% of the volume mass of a conveyor belt and more than 50% of the cost. It is therefore the single biggest opportunity for manufacturers to minimise costs.

The primary cause of rapid belt cover wear is because low grade 'economy' rubber that has inadequate resistance to abrasive wear and cutting has been used rather than using a rubber engineered to provide a high level of resistance and therefore a much longer operational lifetime.

The ability of rubber to withstand wear and tear also depends on its overall strength and its resistance to cut and tear propagation. If the latter is insufficient then even a small, seemingly insignificant area of damage in the cover can easily increase in size due to the continuous material loading and the flexing around the drums and pulleys. In time, this damage will spread and link up with another area of damage. Consequently, small pieces of damaged rubber are effectively cut out from the surface rather than being simply worn thinner.

LIFE-SHORTENING OMISSIONS

Because of its adaptability, most of the rubber used to make conveyor belts is synthetic. Dozens of different chemical components, polymers and substances are used to create the numerous different rubber compounds needed to cope with the different demands that may be placed upon them. For human safety and environmental protection reasons, these chemical components and additives are strictly regulated in Europe. However, such regulation does not apply outside of Europe, including Southeast Asia of course, which is the biggest source of low-price belting. Good quality, regulated raw materials are significantly more costly than low-grade, unregulated raw materials so their use makes an important contribution towards the manufacturer's cost-cutting objectives.

In some cases, despite their enormous influence on the operating life of the belt, some additives are omitted completely because they are seen to be an avoidable cost. One of the best examples of such an omission concerns ozone and ultraviolet light. From a longevity point of view, there is no question that all rubber conveyor belts need to be fully resistant to the damaging effects of ozone and ultraviolet light. This is because at ground-level, ozone becomes a pollutant. Exposure, which is unavoidable, increases the acidity of carbon black surfaces and causes reactions to take place within the molecular structure of the rubber. This has several consequences including surface cracking and a marked decrease in the tensile strength, all of which accelerates the wear and general degradation of the rubber.

Likewise, ultraviolet light from sunlight and fluorescent lighting also accelerates deterioration because it produces photochemical reactions that promote the oxidation of the surface of the rubber resulting in a significant loss of mechanical

Cost-cutting opportunity: rubber resents 70% of the volume and 50% of the cost

strength. Laboratory testing consistently reveals that so-called 'economy' belting is very rarely, if ever, ozone and UV resistant.

LOW-COST COMPONENTS

Yet another connection between price and belt life is carbon black polymer, which is a key component of black rubber. Because it makes up around 20% of a typical rubber compound it is yet another target for cutting costs despite the crucial role that it plays. For example, carbon black prolongs belt life by helping to conduct heat away from the surface area of the belt. This reduces thermal damage and thereby slows the ageing process. It also acts as an important reinforcing compound. Good quality carbon black is costly, especially since the Russian invasion of the Ukraine.

Premium-grade carbon black is more costly because it is created by a process of burning oil in a strictly controlled, low oxygen environment so that combustion is incomplete whereas cheap carbon black is usually produced by burning scrap car tyres. Burning old car tyres not only pollutes the atmosphere it also means that any oils and greases remain present within the 'regenerated' materials, which has a detrimental effect on the physical properties of the rubber. Belts offered with significantly lower prices are virtually certain to contain low-grade carbon black.

Other methods to reduce the cost of the rubber include the use of low-grade (reject) recycled rubber of highly questionable origin and cheap 'bulking' fillers such as chalk, which are used to replace part of more expensive rubber, despite the fact that they limit the life of the belt.

THE CARCASS

Multi-ply construction are the most common type of conveyor belts. These consist of layers of fabric plies, usually

Quantum advances in conveyor belt technology have been made in recent years

Lower-grade carbon black can be produced cheaply by burning scrap car tyres

polyester and nylon (EP). Polyester combined with nylon has the best balance of mechanical properties including allowing a conveyor belt to run straight and true, to trough, to flex round pulleys and drums, stretch, provide sufficient transversal rigidity, longitudinal strength and much more besides. All of which contributes to the working lifetime of the belt.

However, there are often huge differences in the quality of the fabric plies between one belt and another because cheaper, lower quality fabrics are used where the more costly nylon transversal weft material is kept to a minimum. Although the required tensile strength may be achieved, rip and tear resistance are noticeably reduced and elongation (elasticity) will be too low.

An even more dramatic cost-cutting method involves the use of totally polyester (EE) fabric plies in a carcass that is specified as having an EP (polyester/nylon mix) construction. The fabric plies are a major cost component and because polyester (EE) fabric costs around 30% less than polyester/nylon mix fabric (EP) it is a big help when trying to achieve the perception of a lower 'like for like' price.

The use of totally polyester (EE) fabric compromises a numerous essential mechanical properties*. These include low transverse elasticity, which reduces both the troughability and impact resistance of the belt as well as causing tracking issues, a reduction in rip resistance, fastener strength and greater risk of dynamic stress failure. Again, these detrimental physical effects have a significant impact on the life of the belt.

*Author's note: The use of fabrics made entirely of polyester (EE) has its place in certain belt types and constructions – such as those used in saw mills, for example. However, in those cases the declared specification of the belt should clearly be EE and not EP).

A COMBINATION OF WEAKNESSES TO BE CONSIDERED

A huge proportion of conveyor belts in mines and quarries are replaced prematurely because they have been irreparably ripped or torn. In these cases, the type of material being conveyed such as heavy, sharp rocks, is a major factor. For a belt carrying this type of material to provide a cost-effective life cycle means that it must be able to withstand the forces that rip and tear them apart. Such resistance is created by the combination of a high-quality inner carcass and high-quality rubber covers that are durable enough to protect that carcass. If either is lacking, then the belt is highly likely to be destroyed before it has paid for itself.

Knowing how the ultra-competitive prices are often achieved makes it much easier to understand how good quality, European-made belts can consistently provide an operational lifetime that is up to four or five times longer. So, the answer to those two commonly asked questions – "how much does a conveyor belt cost?" and "how long do conveyor belts last?"– is that price ultimately determines the longevity, and it is the longevity that determines the true cost of a conveyor belt. ●

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