‘Problem solver’ conveyor belts

Conveyor belts are critical components within many industries. They are surprisingly complex and their reliability and efficiency can critically affect productivity. Problems such as rip, tear and impact damage and repeated splice joint failures are costly to deal with and can have serious consequences in terms of lost production. Here, conveyor belt specialist Bob Nelson explains why specially engineered belts are different and recommends solutions to two of the toughest problems in conveying.

RIP, TEAR AND IMPACT

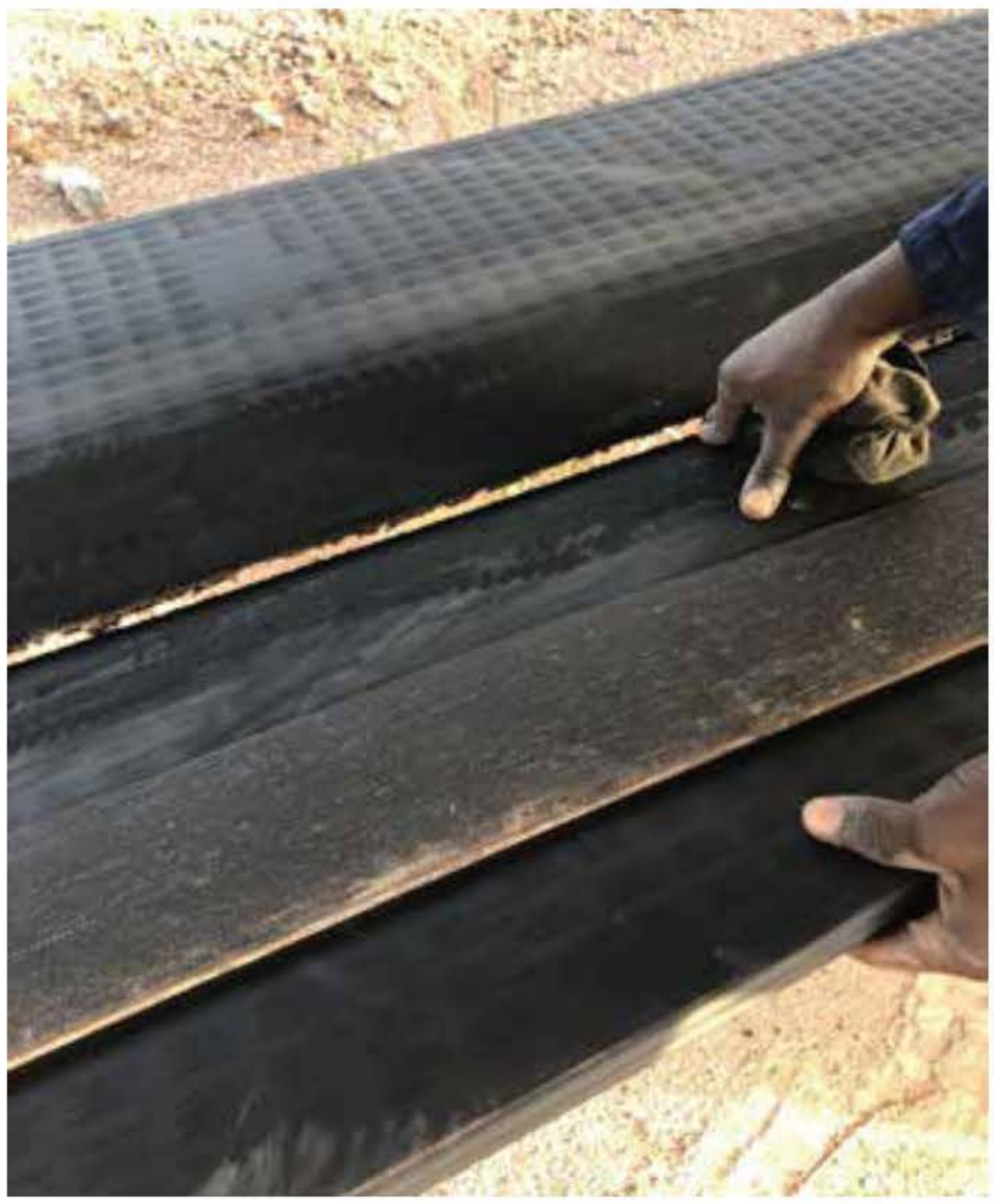
On some applications, the ability of belts to withstand the forces that cause rip, tear and impact damage is often more important than any other physical attribute. A ‘rip’ is best described as what happens when a sharp object punctures the belt and cuts the belt lengthwise as the belt is pulled against the trapped object. In contrast, a ‘tear’ is what happens when a section of belt is pulled apart in opposing directions. This tearing also includes the spreading of small areas of damage or punctures into something much more serious. Impact damage, however, is caused by heavy objects falling from height that can pierce the outer cover and damage the inner carcass.

What is most certainly NOT the answer to rip, tearing and impact damage is increasing the cover thicknesses and/or the tensile strength. Belts that are too thick for the design of the conveyor can cause different problems such as excessive rigidity (lack of troughability), steering and handling difficulties plus the very real possibility of dynamic stress failure of the belt carcass as well as recurring splice joint problems.

NOT WORTH THE SACRIFICE

When faced with repeated damage problems, one course of action is to opt for low grade, ‘sacrificial’ belts most typically imported from Asia. The sentiment seems to be that it is not worth paying good money for a belt that probably sooner rather than later will become damaged beyond repair. For me, this attitude does not make sense either economically or environmentally because it results in a lot of avoidable waste, unplanned stoppages and costs.

The materials represent up to 70% of the cost of making a conveyor belt and the only way to achieve ultra-low prices is to use low quality, unregulated raw materials. As a consequence, low-grade belts lack the necessary durability and are very easily damaged. When you add the cost of incessant patch repairs, the splice repairs, the cost of replacement belt after

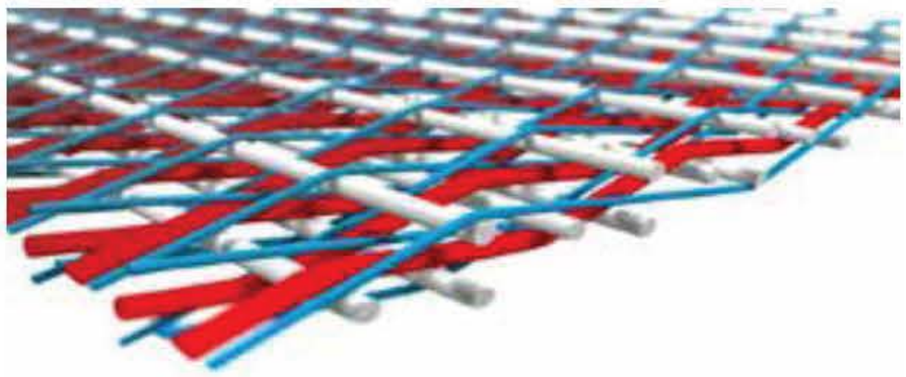


Longitudinal rips can be very expensive in every respect.

replacement belt together with the invisible 'un-invoiced' cost of the lost production while all those unplanned stoppages are taking place, the true cost is several times higher than the price paid for the original belt. As the old saying goes, price is what you pay but cost is what you spend. The fact is that for conveyor systems where ripping and tearing is a problem, the most practical and economical solution is to fit a conveyor belt that has a carcass and rubber that have been specifically engineered for the purpose.

ENGINEERED FOR THE TASK

Whenever rip, tear and/or impact damage is a concern, I recommend the use of single or dual-ply Fenner Dunlop UsFlex, even for the heaviest, most demanding applications. Although conventional wisdom would seem to dictate that a thick carcass with a higher number of inner plies will result in a stronger belt, this is not the case. The greatest influence on the strength of a conveyor belt is the actual design and physical properties of the ply material used to create the carcass.



UsFlex belts have uniquely designed super-strong fabric plies that allow the strands to gather to create amazing rip resistance.

The big advantage of the unique UsFlex carcass construction is that it has three or more times the resistance to ripping, tearing and impact compared to steel reinforced and other conventional heavy-duty belt constructions of a similar tensile strength. Protected by premium grade rubber covers, UsFlex is proven to provide up to four or five times longer operational life, especially when compared to belts imported from Southeast Asia. Although their buying price may be appreciably higher, their cost over their working lifetime is substantially less.

HOW DOES IT WORK?

What makes the UsFlex belt different is the unique, super-strong fabric ply that is manufactured in their own fabric weaving center in the USA. As the belt is being pulled through a trapped object, the design pattern of the strands allows them to gather together into a bundle that can eventually become strong enough to stop the belt or expel the trapped object. Strange as it may seem, synthetic plies are usually more effective than steel when it comes to actually minimising the length of a rip. In fact, the UsFlex fabric is so strong that it is used as a breaker ply in their steel cord belts.

THE ULTIMATE SOLUTION

It is not difficult to understand why specialist belts last so long when you hear about amazing tales of their strength like one that recently occurred in Scotland where several large pieces of granite became jammed against the tail pulley (see photo). The force was so strong that it dislocated the complete steel construction on which the tail and tensioning pulley was mounted. Amazingly, the UsFlex 1000/2 belt did not break. Instead, it simply kept on running, which just goes to show how fantastically strong these specialist belts really are and why they are considered to be the ultimate problem solver.

As with most successful products, there are several imitators who claim to have equally outstanding rip and tear resistance. However, the warning sign is that they are priced considerably lower. How this is achieved is probably best explained by the fact that, as laboratory testing consistently confirms, their rip and tear resistance is more than 60% lower than the real thing.

RECURRING SPLICE JOINT FAILURES

An even more common problem than rip and impact damage

'Sacrificial' belts sacrifice productivity, money and time.

Trapped granite buckled the conveyor, but the UsFlex belt kept on rolling

is splice joint failure. The weakest point of any conveyor belt is the splice joint. In fact, it is estimated that nearly 80 percent of all conveyor stoppages are caused by splice joint problems. Because of the potential loss of output, as well as the safety implications, it is critically important to maximize the strength and long-term durability of the joint.

The most common method of making a splice joint is the step splice, which requires the removal of one of the layers of fabric plies so that the two belt ends can be overlapped and then either cold glued or hot vulcanized together. This method is popular because it is seen to be generally easier and quicker to make a step splice. However, these 'advantages' come at the expense of the far superior strength and reliability achieved by using the finger splice jointing method. For those who may not be familiar with the term, finger splicing is where a zigzag pattern is cut into both sides of the belt ends, creating several interlocking 'fingers'. These are then carefully aligned, interlocked together and finally bonded using a hot vulcanizing press to make a splice that is very strong and flat.

Regardless of the method used, it is not physically possible to join a belt without some loss of longitudinal tensile strength, However , the big disadvantage of the standard step splice is that it will always create a proportional loss of tensile strength equivalent to one ply.

As can be seen in **Table 1**, a 3-ply step joint can only achieve a maximum longitudinal tensile strength of 67%. This effectively means that in a typical multi-ply belt containing three plies or more, at least one ply exists purely to compensate for loss of the longitudinal strength incurred by making a step splice joint. In contrast, the finger splice method retains up to 90% of the belt's 'static' tensile strength. Another advantage is that the finger splice is much more resistant to dynamic stress failure. Very importantly, this superior strength and durability

Table 1

No. of plies	Maximum % tensile strength
1	90%
2	50%
3	67%
4	75%
5	80%

also reduces the need to repair and re-splice, thereby significantly reducing both direct (actual repair) and indirect (lost output) costs.

In my view, the biggest opportunity of all is the very real chance to install a much more reliable and consequently lower 'whole-life' cost 'problem solver' belt in the form of Fenner Dunlop's revolutionary single-ply Ultra X belt. As with UsFlex, the secret behind the Ultra X phenomenon is its 'in-house' unique super-strength fabric that possesses more than 3 times greater longitudinal rip resistance, up to 5 times better tear resistance and a far better resistance to impact compared to traditional 3-ply or even 4-ply belting.

Finger splice joints are much stronger and reliable.

Ironically, the finger splice is an integral factor in the success of Ultra X because of the vastly superior splice joint strength and reliability. For example, one quarry in the UK had been replacing splices on its multi-ply belts every three months. However, more than 18 months after installing Ultra X single-ply belts, it had not been necessary to repair or replace a single splice.

NEW WAYS TO SOLVE OLD PROBLEMS.

For some, the very idea that a conveyor belt with only one or two plies can be dramatically stronger than a belt with multiple plies may not make much sense but the answer lies with manufacturers who are prepared to innovate using modern technology to find new ways to solve old problems. As a result, problem solver belts like UsFlex and Ultra X consistently prove themselves to be the cheapest to run because that is exactly what they are designed to do, which is to run and run and run. Problem solved.

AUTHOR

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