

# Looking to the future

## maximizing the life of conveyor belts



Leslie David

They are stronger, lighter, far more resilient, longer-lasting and much more eco-friendly. Are single-ply and dual-ply industrial conveyor belts the future? At least one leading manufacturer seems to think so. Here is how and why.

### A BRIEF HISTORY

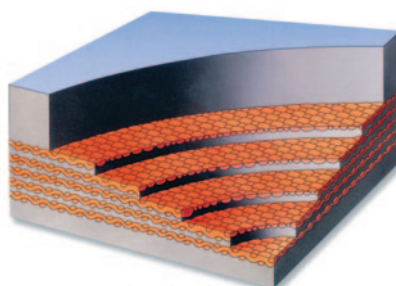
The basic construction of rubber conveyor belts has not changed fundamentally since 1905 when mining engineer Richard Sutcliffe invented a belt made from layered cotton and rubber. Since those times, because of its vastly superior adaptability, most of the rubber is now synthetic and the layers of cotton have long-since been replaced by layers of synthetic (usually polyester and polyamide) fabric ply material with a thin layer (skim) of rubber in between each layer.

This multi-layered carcass structure usually consists of three or four layers but belts for extremely heavy-duty applications can have as many as five or more layers of synthetic ply, all of which are protected by

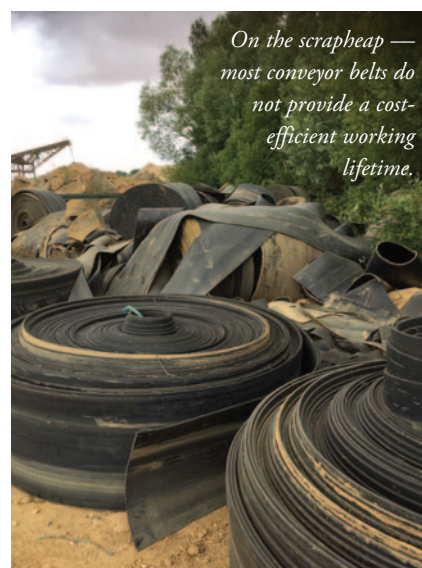
an outer layer of rubber. Known the world over as 'multi-ply' belts, they are by far the most common type of conveyor belt.

### UNACCEPTABLY SHORT WORKING LIFE

Although much progress has been made over the years, the fact remains that nowadays, for a variety of reasons, especially those involving price cutting and imports from Southeast Asia, the vast majority of belts do not provide a cost-efficient working lifetime. General surface wear and tear, cutting, gouging and rubber



Conventional multi-ply construction.



*On the scrapheap — most conveyor belts do not provide a cost-efficient working lifetime.*

degradation caused by exposure to ozone and ultraviolet light are all common causes. Add to this rip, tear and impact damage which, depending on industry type, can result in as much as 75% of conveyor belting needing to be replaced much

sooner than it should be.

To many in bulk handling, catastrophic rip and tear damage is considered to be inevitable. As a consequence, growing numbers have fallen into the trap of using low price imported 'sacrificial' belts. Ironically, low-grade belts have much less ability to resist damage, resulting in an even faster, more expensive cycle of fitting, repairing and replacing. However, one leading conveyor belt manufacturer, Fenner Dunlop conveyor belting, saw things differently and were prepared to bring about a radical change of thinking.

### A POWERFUL PARTNERSHIP

Perhaps at this stage it is a good idea to explain who we are talking about. Based in Europe (the Netherlands to be precise) is Fenner Dunlop BV trading under the name Dunlop Conveyor Belting. Formed more than 100 years ago, they have built a market-leading reputation for product quality and longevity. Meanwhile, on the other side of the Atlantic, are their North American cousins, Fenner Dunlop Conveying Belting. Under the leadership of their mutual boss, Edwin Have, who is Executive Director of Fenner Dunlop in the Northern Hemisphere, they pooled their considerable knowledge, experience and resources in order to create a new generation of super-tough belt that was both more affordable and environmentally sustainable.

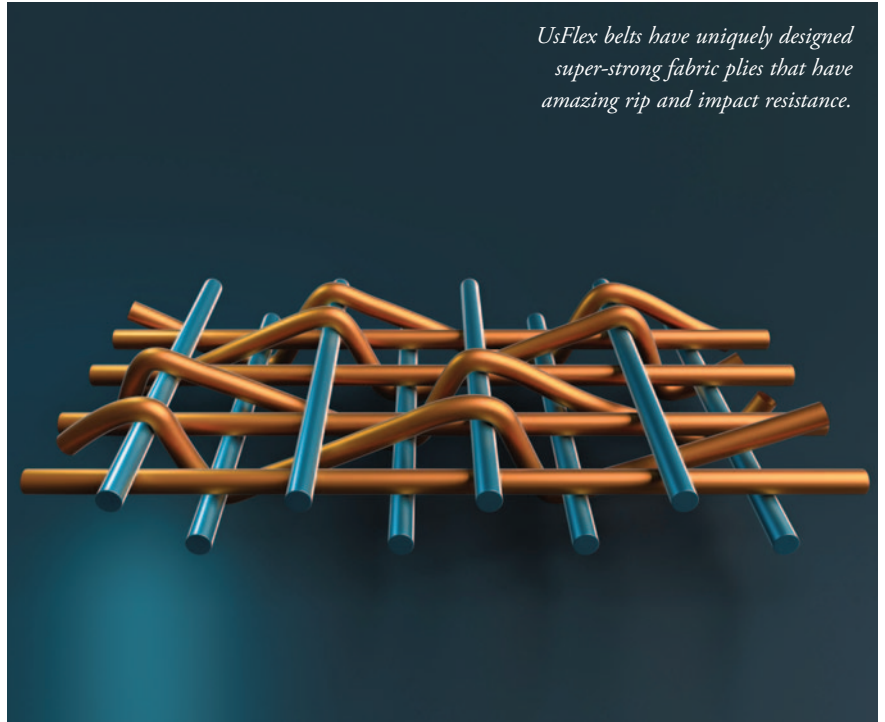
Having already developed extremely hard-wearing rubber compounds, their engineers and technicians focussed on the carcass. Better still, they decided to build on a product that continues to enjoy an unrivalled reputation for toughness and longevity on both sides of the Atlantic — the single and dual-ply UsFlex construction.

### DUAL-PLY — THE USFLEX PHENOMENON

Unique to Fenner Dunlop and first introduced more than two decades ago, UsFlex combines premium grade rubber covers with uniquely designed super-strong fabric plies. Although available as a single-ply construction for lower tensile strength (up to 630Nmm) applications, the most popular version of UsFlex is the dual-ply 1,000Nmm.

Conventional wisdom would seem to indicate that a higher number of inner plies will result in a stronger belt but this is not the case. The greatest influence on the strength and other essential physical properties of a conveyor belt is the design and quality of the ply material used to create the carcass.

In the case of UsFlex, a unique, specially



*UsFlex belts have uniquely designed super-strong fabric plies that have amazing rip and impact resistance.*



*Tested to destruction — more than five times the longitudinal rip resistance and up to three times greater impact resistance compared with conventional belting.*

woven fabric is the secret behind its success. The fabric consists of heavy strands of polyester running lengthwise and heavy nylon strands running crosswise held in position by a strong yarn. The strands are completely straight in both directions and not interlocked like a conventional fabric. This allows the weft to float free from the warp, thereby minimizing the peak point of impact because the energy is dissipated over a larger area.

This means that if a sharp object penetrates the carcass and becomes trapped and the belt is then being pulled through it, the design pattern of the strands allows them to gather in a bundle that can eventually become strong enough to stop the belt or even expel the object causing the damage. Strange as it may seem, synthetic plies are usually more effective than steel when it comes to minimizing the length of a rip. In fact, the UsFlex fabric is so strong that Fenner Dunlop use it as a breaker ply in their steel cord belts.

The result is that both the single and dual-ply UsFlex belt carcasses possess a longitudinal rip resistance that is more than

five times that of multi-ply belts of equivalent rating and an impact resistance that is up to three times greater compared to conventional belting. Protected by premium grade rubber covers, UsFlex belts established a long-standing reputation for being able to provide up to four or five times longer operational life, especially when compared to imported belts. As one European quarry manager was happy to testify, "We used to replace our belts every three to six months before we started fitting UsFlex belts. Now it can be four or five years before we need to fit a replacement."

### ULTRA X — A SINGULAR SUCCESS

Given the success of UsFlex as an extreme conditions problem-solver belt, it is hardly surprising that Fenner Dunlop were keen to harness the concept. The big advantage they had was having an in-house fabric weaving facility located in the USA where new thinking could be limitlessly explored. The result of their R&D efforts was the creation of a new and unique super-strength single-ply belt that they named



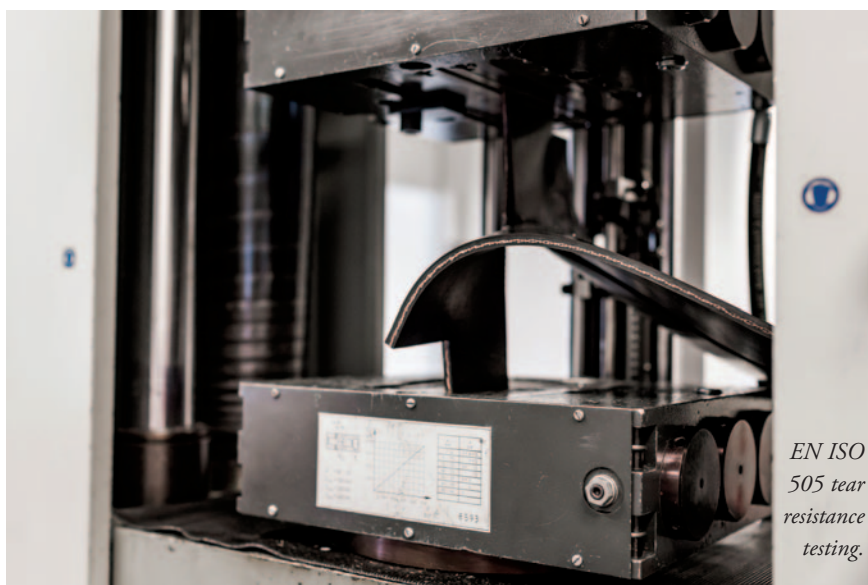
Home advantage — Fenner Dunlop's in-house fabric weaving facility in Lavonia, USA.



Ultra X and which became part of what they call 'The X Series'.

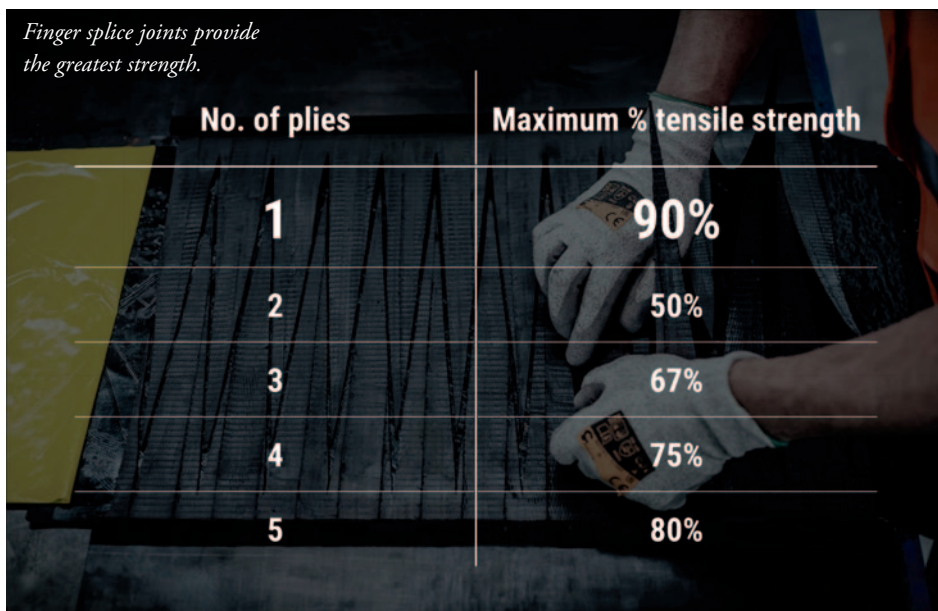
Throughout the development of Ultra X, sections of belt carcass were repeatedly tested to destruction, including measuring the tear resistance according to the international EN ISO 505 standard. The tests revealed that the new (Ultra X) fabric possessed more than three times greater longitudinal rip resistance, up to five times better tear resistance and a far superior resistance to impact compared to traditional three-ply or even four-ply belting.

There was also no question about the overall strength. For example, the Ultra X3 single ply belt proved capable of pulling up to 56 tonnes in weight.



EN ISO 505 tear resistance testing.

Finger splice joints provide the greatest strength.



**A QUESTION OF STRENGTH**

Fenner Dunlop openly admits that the Ultra X single-ply construction did raise a few eyebrows at first. According to Dr. Michiel Eijpe, Fenner Dunlop's Innovation & Sustainability Director in the Netherlands, the answer lies not only with the special fabric but also the advantages of finger splices.

"First and foremost, the fabric created by our colleagues in the USA is able to withstand the kind of punishment that would destroy a normal belt. Ultra X also has amazing tensile strength. For example, the



*Less environmental impact — less energy, less rubber, fewer synthetic fabrics, fewer chemicals.*



longitudinal tensile strength of the X1 is 330N/mm and the X3 has a longitudinal strength of 550N/mm. A single-ply construction requires a finger-splice joint to be made and the enormous advantage of finger splice joints is that they retain up to 90% of the belt's tensile strength. By comparison, a 3-ply step joint only retains a maximum of 67%".

The higher level of splice efficiency combined with the tensile strength effectively creates equivalent tensile strengths and belt safety factors that are more than comparable to three- or four-layer conventional belting. Although finger splices may concern those who have no previous experience of making them, the technical and economic arguments in their favour are unquestionable. Finger splice joints are proven to be stronger and more durable so the need to repair and re-splice joints is almost non-existent.

#### BETTER FOR THE ENVIRONMENT

The reduction in environmental impact of single and dual-ply belts is also considerable. Having only one or two layers rather than three, four or more layers helps to reduce energy consumption and maximize efficiency of production because there are fewer calender (layering) runs.

It also means that less rubber is used,

including a corresponding reduction in the amount of chemicals and additives used to create that rubber. The dramatic reduction in the amount of nylon and polyester used in the creation of a single layer of fabric compared to the multiple layers found in a conventional multi-ply belt is particularly important because synthetic fabrics are not biodegradable. The vastly superior toughness of Ultra X and UsFlex belts also means that they need to be replaced far less frequently, which consequently means that far fewer conveyor belts have to be manufactured and shipped enormous distances in the first place.

#### A SINGLE AND DUAL-PLY FUTURE

For some, the very idea that single and dual-ply belts can provide considerably more resistance to wear and damage compared to much thicker, heavier belts with multiple plies is difficult to comprehend. However, the evidence is overwhelming. UsFlex is long established while Ultra X has continued to prove a great success since its launch some six years ago and is now the belt of choice in a rapidly increasing number of operations across a wide cross-section of industries and countries. Fenner Dunlop's management

certainly regard single-ply and dual-ply belts as the future of industrial conveying belt. Given the evidence, who could argue?

#### ABOUT THE AUTHOR

After spending 23 years in logistics management, Leslie David has specialized in conveyor belting for over 17 years. During that time, he has become one of the most published authors on conveyor belt technology in the world.

DCi



*Leslie David.*