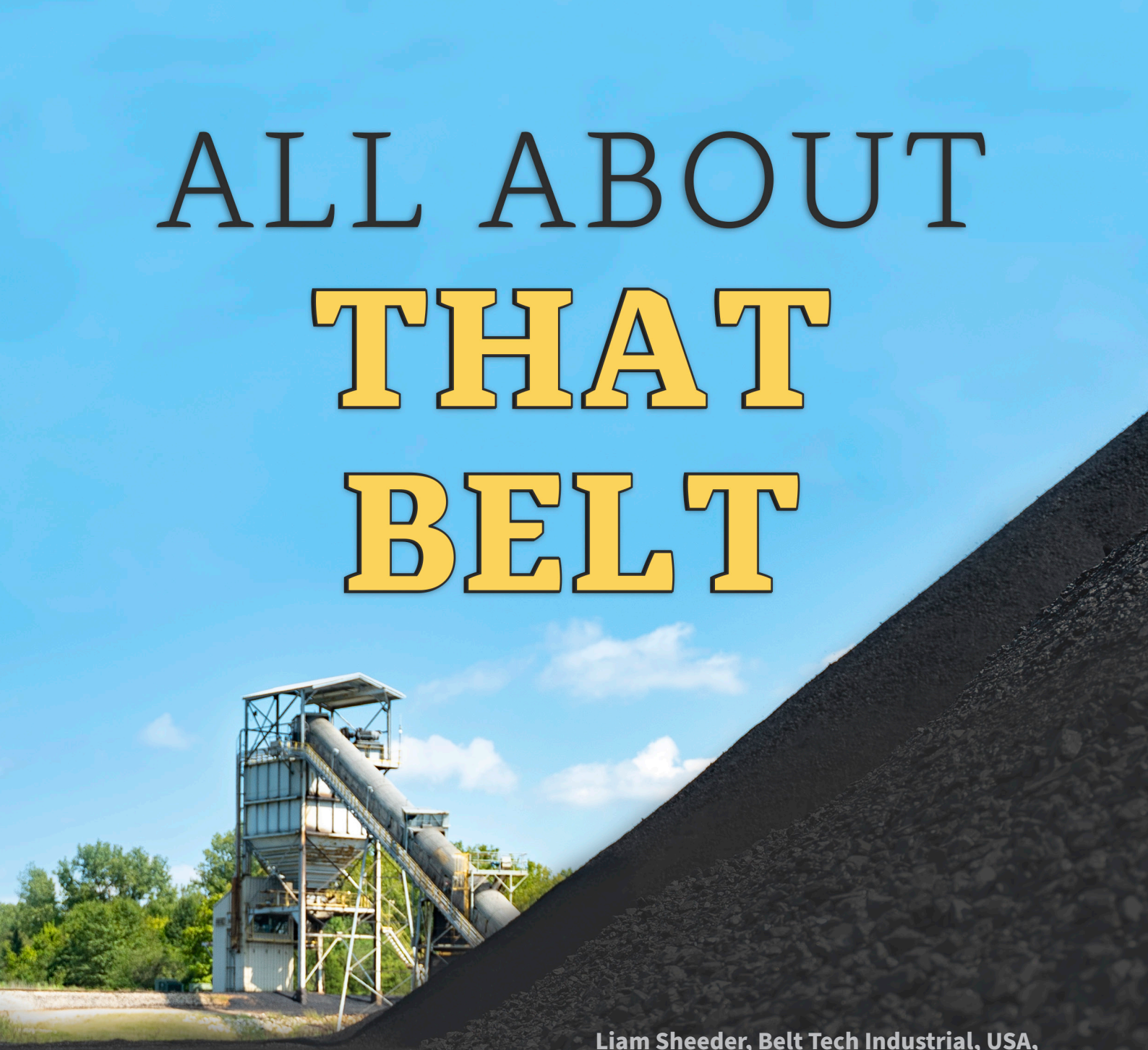
ALL ABOUT THAT BELT



Liam Sheeder, Belt Tech Industrial, USA, discusses optimising conveyor belt selection by balancing durability, efficiency, and cost-effectiveness.

Conveyor belt technology has come a long way. This article looks at some key differences between straight warp and ply belts, how end users can make a choice that optimises production and profit, the power of keeping good records, and how making even small improvements can have big payoffs.

In every conveyor installation, there are certain applications where the normal expected belt life significantly deteriorates due to continuous abuse. This results in premature failure caused by a rip, tear, and carcass fracture. The ripple effect of a single belt failing could compound into a tsunami of lost production and financial implications that are not easy to recover from.

When this happens, managers may be tempted to either go with a heavier, thicker belt or to buy used belts and change them out more frequently, sacrificing them on the altar of 'the cost of doing business'. Unfortunately, if there are no records to indicate what has been tried in the past, mistakes will tend to be repeated, especially when management changes hands.

There is a time and a place for all kinds of solutions, but this article will examine the benefits of making an informed decision. In particular, it will consider the differences between straight warp or plain-weave ply belts, the pros and cons, and how operators can arm themselves with data.

Understanding the difference

What is the difference between a straight warp and ply belt? A ply belt, also known as a multi-ply belt, comprises multiple layers of synthetic fabric or polyester and nylon woven materials. These layers are bonded together with rubber to form a durable and flexible belt (see Figure 1). They offer good strength and are commonly used for general conveying applications in various industries.

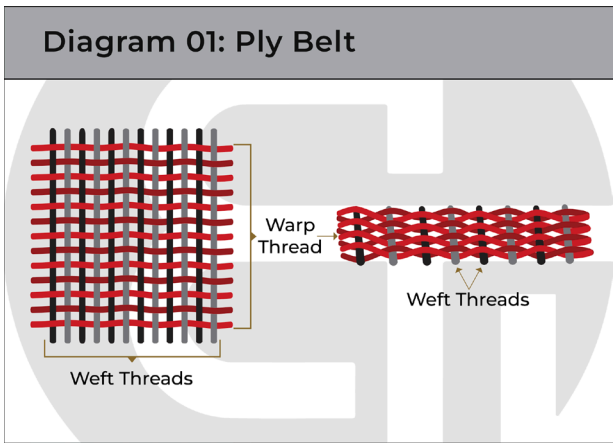


Figure 1. A ply belt carcass utilises a familiar woven pattern.

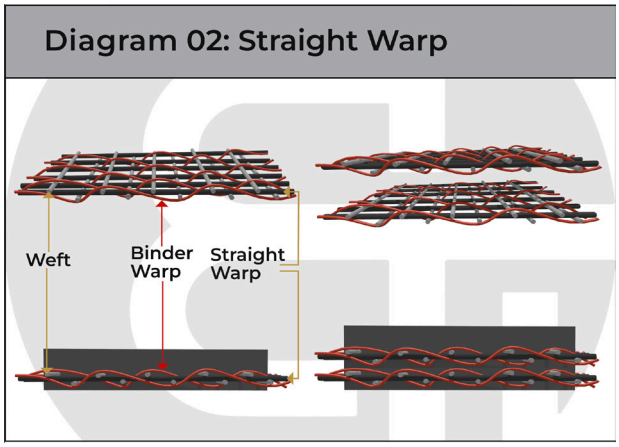


Figure 2. This unusual configuration is the key to a straight warp carcass strength, rip, and tear resistance.

Figure 3. Just like different articles of clothing are better suited to certain tasks, different kinds of belt are better suited to certain applications.

Straight warp belts typically consist of a single layer of longitudinal cords. The warp and the weft do not intertwine, instead they are joined with a binder warp (see Figure 2).

Straight warp can be imagined as a sort of rip-stop fabric. This kind of fabric incorporates reinforcement threads that are placed in a crosshatch pattern. Should a puncture occur, the reinforcement threads surrounding the damaged spot help to contain the tear, preventing it from going further. The same principle that makes rip-stop fabric effective, is at work with a straight warp belt.

A plain-weave ply belt has warp and weft yarns that are interwoven. This weaving crimps the yarn, weakening and stretching it to some extent. This does not mean it is weak, only that it loses some strength.

Therefore, does this mean that straight warp is always the best choice? Not necessarily. To take an example, boots and gloves have different strengths, but, ultimately, we need both. Coats and hardhats are constructed completely differently, but one is not better than the other, they both have their place. Further, if you try to wear boots on your hands or gloves on your feet it will make for a very interesting day's work (see Figure 3).

Similarly, it is always advantageous to choose the best belt for the need.

Ply belt and straight warp: Pros and cons

Complicated decisions can be simplified by looking at the pros and cons. Figures 4 and 5 present some for both ply belt and straight warp.

When adding up the differences, it becomes clear that there are uses for both kinds of belt. Furthermore, within this broad category of ply and straight warp there is a lot of variety. Therefore, beyond pros and cons, making the right choice involves three things: 1) Understanding the needs of each section of the conveyor system, 2) Keeping and consulting records to identify problem areas and what has worked or did not work in the past, and 3) Considering which conveyor belt will actually reduce the cost per tonne of operations, not which belt costs less up front.

Making an informed decision

Each section of a conveyor system experiences its own set of challenges. An underground section is going to experience higher humidity, dust, and potentially corrosive substances. Run-of-mine (ROM) belts might experience greater impacts, heavier loads, high volumes of coal, or longer runs. Feeder belts require frequent cleaning. Operators are in the best position to know what is working or not.

There are several factors to be considered when selecting a belt for any given section. Some that readily come to mind are considering the makeup of the material, the height of a drop zone, the trajectory of the material being loaded in relation to the direction of the conveyor, and so on. How long is the belt? The longer the belt, the less impacts per minute. In contrast, a shorter

belt will experience far more impacts every minute and ultimately tends to wear out faster in the same way that certain parts of boots tend to wear out before others.

Further considerations include: the belt width, the maximum operating tension (both steady state condition and peak), the minimum number of plies required to support the load, and the maximum number of plies beyond which transverse flexibility is reduced and troughing efficiency is affected. What kind of splice will be used? A vulcanised splice will allow a belt to be operated closer to the belt rating than a mechanical splice.

If the details are recorded, a manager can make an informed decision. These are also questions that a belt supplier will be asking. Knowing the answers can help them provide the best guidance.

PLY BELTS	
PROS	**CONS**
Suitable for various industries and applications.	May have a lower tensile strength than a straight warp belt of similar weight.
They handle different materials and products well.	They tend to exhibit more stretch or elongation under load.
Generally, ply belts are more affordable compared to some specialized belt types.	In abrasive environments, they might wear out faster leading to a shorter lifespan in certain conditions.
If damaged, ply belts can be easier to repair or splice compared to some other belt types, reducing downtime during maintenance.	They may not provide the same level of impact resistance as specialized belts, potentially resulting in higher susceptibility to damage from impacts or sharp materials.
Widely available, come in various configurations and readily accessible for different conveyor setups.	While repairs are easier, ply belts might require more frequent maintenance compared to some specialized belts to maintain optimal performance.

Figure 4. Pros and cons for ply belt.

STRAIGHT WARP BELTS	
PROS	**CONS**
Excels at withstanding heavy impacts, making them suitable for applications involving sharp or abrasive materials.	Tends to be more expensive per foot, compared to ply belts.
Generally higher tensile strength than a ply belt of similar weight.	They might be less adaptable to handling a wide range of materials or products compared to more flexible belt types like ply belts.
Known for durability and longer lifespan, reducing the frequency of replacements and downtime for maintenance.	Optimized for specific heavy-duty applications, which may be overkill for general use.
Exhibits lower stretch or elongation under load.	Installation and maintenance might require specialized expertise and therefore a higher cost up front.
A thinner carcass, thinner belt, smaller drum size and less weight (5-20% less in some cases) can mean energy savings and improved efficiency.	

Figure 5. Pros and cons for straight warp.

Finally, performing a cost/benefit analysis can remove the haze of indecision by providing cold hard facts. It may reveal that a higher up-front investment will be worth it or it may show where funds could be better spent.

The power of small improvements

The real issue is not so much which kind of carcass or belt is good and which is bad; it is which is best for the situation. The only way to know this is to keep a record and really understand the system. It is important to standardise before being able to optimise.

For example, when reviewing records, an operator may notice that one conveyor is consistently having issues with rips or tears, and records indicate that a used belt has been installed in the past. The operator has looked at the impact zone and a complete redesign is not practical or economically feasible. It is also evident that it is a shorter conveyor and is receiving consistent and continuous impacts.

Bearing this in mind, the operator runs the numbers, considering more than just the 'cost per foot' of the belt. Instead, they consider which option is going to actually reduce their operating 'cost per tonne'. The numbers indicate that one slightly more expensive belt is more cost-effective than multiple belt changes.

Even the simple act of recording observations is powerful. If there is a change in management, those records can ensure that an operation continues to make consistent improvements, no matter how small they are.

Conclusion

There is not one kind of belt or belt carcass that is best in every situation. It is important to understand some of the key differences and to consult with a belt supplier to discuss specific needs.

Choosing the most expensive option is not always necessary. A small, well-planned, specific improvement may provide a bigger payoff than major changes or repairs that spring from emergency situations.

Optimising conveyor systems does not result from one grand effort. Like the single grains making up a stock pile, small consistent improvements turn into huge payoffs. WC