Conveyors Q&A

Dry Bulk Magazine asked leading players in the conveyor sector for their insights on a range of topics covering everything from extending belt life to minimising dust and spillage.

Bühler Group
Tobias Mehringer – Head of Product Management Grain Handling

Tobias Mehringer has been working for Bühler for 15 years and currently serves as the Head of Product Management Grain Handling. His diverse background includes Technical Draftsman, Lifecycle Manager, Commissioning Engineer and Technologist, and in his ongoing capacity as the Head of Product Management Grain Handling he plays a pivotal role in shaping the global strategy and portfolio development for Bühler's state-of-the-art conveying systems.

Fenner Dunlop Conveyor Belting
Rob van Oijen – Application Engineering Manager

Rob van Oijen is the Manager of Application Engineering for Fenner Dunlop Conveyor Belting in The Netherlands. Rob has specialised in conveyors for over 16 years, supporting businesses throughout Europe, Africa, the Middle East and South America and is regarded as being one of the best application engineers in the conveyor belt industry.

Gambarotta Gschwendt Srl.
Davide Gambarotta – CEO

The new establishment of the Gambarotta Group, led by the current CEO, Davide Gambarotta, took place between 2019 and 2020 and is made up of five leading companies in the sector and about 130 people specialised in 44 different fields. The companies involved are: Gambarotta Gschwendt SRL, Gambarotta Australia, MDG Handling Solutions SRL, MDG America Inc. and Ossitaglio SRL.

Martin Engineering
Daniel Marshall – Process Engineer

Daniel Marshall received his Bachelor of Science degree in Mechanical Engineering from Northern Arizona University. With nearly 20 years at Martin Engineering, Daniel has been instrumental in the development and promotion of multiple belt conveyor products. He is widely known for his work in dust suppression and considered a leading expert in this area. A prolific writer, Daniel has published over two dozen articles covering various topics for the belt conveyor industry; he has presented at more than fifteen conferences and is sought after for his expertise and advice.

Richwood
CJ Ferguson – Chief Applications Manager

CJ serves as the Chief Applications Manager at Richwood. He has over 35 years of experience in bulk material handling and conveyor components.

What factors need to be considered when installing a conveyor system for dry bulk materials?

Tobias Mehringer – Bühler Group

First and foremost, the type of conveyor must match the application – there are factors to consider like the angle, the type of bulk and the length/height the material needs to be conveyed. Also there can be specific legislation depending on the country where the conveyor is going to be installed, like explosion protection or food regulations. What we also want to mention is that a conveyor must be seen as one part of the whole plant and its inputs and outputs – this means the machines before and after the conveyor also need to be matched and engineered with a holistic approach.

Rob van Oijen – Fenner Dunlop

In terms of the actual conveyor set-up, if biomass is expected to be one of the cargoes then I would strongly recommend the use of covers over exposed areas to provide some protection from rain. This is because biomass dust can be highly prone to self-ignition if it becomes damp. A chemical reaction can take place that causes self-heating and what is referred to as 'off-gassing', emitting carbon dioxide, carbon monoxide and methane emissions. Dust from other bulk materials such as wheat grain is also potentially dangerous, so a good dust extraction system is also essential.

Figure 1. Conveyor Material Containment System. Image courtesy of Richwood.

Figure 2. Redesigned loading zones for better loading, centring, and alignment. Image courtesy of Martin Engineering.

Strict conformity to Directive 2014/34/EU (applicable to potentially explosive atmospheres of ATEX zones 20, 21 and 22 where combustible dust is present) should be a pre-requisite. The key component will of course be the conveyor belt. In the production process of biomass wood pellets, wood chip and similar renewable resources, the materials are continually broken down. This results in high levels of dry, combustible dust that can be ignited by static electricity created within the conveyor system that only requires ignition energy as low as 17 mJ. It is therefore essential that the electrostatic discharge ability (anti-static) properties of the conveyor belt cover rubber (according to DIN EN ISO 284 test methods) do not exceed the maximum resistance value of 300 MΩ.

Currently it is not possible to obtain an ATEX certificate for a conveyor belt because belts are classified as a component. ATEX certification only applies to the whole conveyor. Operators should always request a copy of a certificate from the belt manufacturer that confirms the anti-static properties of the belt.

Davide Gambarotta – Gambarotta Gschwendt

First of all we need to get from our client all the material data, such as bulk density, grain size, humidity rate, stickiness etc. Secondly, we analyse the machine scope of work and its layout: vertical, inclined, horizontal.

Thirdly, we take into consideration the machine capacity, in order to select its proper dimensions.

Then we analyse the site conditions (temperature, indoor/outdoor, humidity) and any specific requirements according to the customer's needs (painting, materials, colour).

Daniel Marshall – Martin Engineering

Operators should consider the cost of ownership. Purchasing based on the lowest bid generally leads to costly issues in the future. Low-quality components tend to wear and break faster. The downtime and maintenance costs alone raise the cost of ownership far above the ROI and long-term savings of reasonable mid-range bids provided by reputable manufacturers of high-quality equipment.

Tell us about one of your most popular conveyor systems. What is special about the design?

Tobias Mehringer – Bühler Group

The Tubular Push Conveyor (TUBO) stands out as one of the newest additions to our conveyor portfolio, and is experiencing strong growth. This conveyor system sets new standards for the transportation of bulk materials. Unlike traditional systems, it conveys materials through a closed pipe using TUBIT push elements. This concept/design has numerous advantages that make TUBO truly distinctive – three-dimensional plant layouts facilitate highly adaptable plant engineering, ensuring improved hygiene, enhanced energy efficiency, and gentle material conveying. These features collectively guarantee a sustainable investment.

Davide Gambarotta – Gambarotta Gschwendt

In several industrial sectors, the need for vertically lifting free flowing bulk material, of any type and size, can be satisfied by the various types of bucket elevators designed and manufactured by Gambarotta Gschwendt.

Three different categories of bucket elevators are available:

- High-speed bucket elevators: used for dusty or small-sized materials (less than 40 mm).
- Medium-speed bucket elevators: generally used for medium-sized materials (between 40 – 80 mm).
- Low-speed bucket elevators: suitable for large-sized materials (even up to 300 mm or more).

Gambarotta Gschwendt is able to revamp, modify and enhance elevators of manufacturers and solve problems regarding the handling of continuous flowing bulk material. Moreover, the company is able to supply any spare part for lifting and hauling machines.

Daniel Marshall – Martin Engineering

We do not manufacture conveyor systems, but we produce accessories that make belt conveyors safer and more efficient. Retrofitting our belt conveyor accessories based on the needs of the application and the production environment results in less dust, spillage, and carryback.

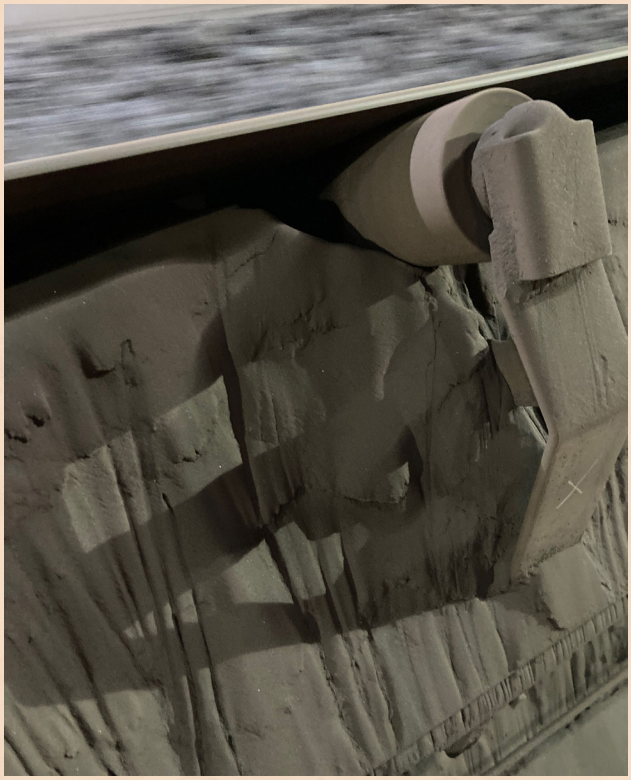


Figure 3. Material build-up accelerates wear of the belt and other components. Image courtesy of Fenner Dunlop.

Figure 4. Bühler's enclosed belt conveyors at COFCO International's Timbúes facility, installed in 2023, Argentina. Image courtesy of Bühler.

What can be done to minimise dust emissions and product spillage?

Tobias Mehringer – Bühler Group

Those steps are mostly carried out in the planning phase. For example, if dust emission control is important, then the client should choose a closed design with aspiration – either an enclosed belt conveyor like our LBIA or a chain conveyor like our AHKG. Our elevators can also be attached to these aspiration systems, to reduce the dust emission to a bare minimum. Spillage in a closed system can occur when the conveyor is overloaded during operation and needs to be emptied to restart – to prevent this, it is important to not overload any part of the system. Furthermore, we have implemented design optimisations in our closed conveyors, enabling the conveyed products to be redirected to the top belt and effectively preventing product accumulation.

Rob van Oijen – Fenner Dunlop

In my experience, dust emissions occur at the loading point, at the discharge, or due to dust emissions from cracks in the rubber covers of the conveyor belt caused by exposure to ozone pollution and ultraviolet light. As for the latter, at low altitude, ozone becomes a pollutant that is created by the photolysis of nitrogen dioxide (NO_2). Exposure is unavoidable because even tiny traces of ozone in the air will attack the molecular structure of rubber, increasing the acidity of carbon black surfaces.

Small transversal cracks begin to appear in the surface of unprotected rubber at a surprisingly early stage. Although the cracks may not seem to be a big problem, the rubber quickly becomes increasingly brittle and the cracks deepen under the repeated stress of passing over the pulleys and drums.

Ultraviolet light also accelerates the deterioration of the rubber. Fine dust penetrates the cracks caused by the effects of ozone and UV and is then discharged (shaken out) on the return (underside) run.

Protection against ozone and ultraviolet damage is relatively easy to achieve by including antioxidants within the rubber compound mixing process, although lots of ‘economy’ belts sold in Europe, Asia and Africa have virtually no in-built protection. My advice is to always make ozone & UV resistance a requirement when selecting any rubber conveyor belt.

Dust emissions at discharge occur from agitation of the material, which can usually be controlled with proper chute design with dedusting equipment, use of loading spouts and limiting ‘free’ movement of material. Dust emissions at the belt loading-end can be reduced by positioning the chute so that it projects the material in the belt movement direction and limiting free-fall heoght and velocity differences. Enclosures around the loading zone with proper sealing to the belt and equipped with dedusting devices allow materials to settle.

Product spillage either occurs around the loading area, due to overloading and/or due to misalignment of the belt. Misalignment is mostly a maintenance issue while overloading is a process issue. Both will cause spillage as of the loading point. However, improper sealing of the loading also allows materials to escape. Misaligned or mismatched idlers stations cause belt height fluctuations and opening of the seal.

Davide Gambarotta – Gambarotta Gschwendt

Dust and spillages can be minimised thanks to an accurate design process and on-field experience we have gained over the years. On a project-by-project basis Gambarotta Gschwendt can select hermetically closed conveyors, such as drag chain conveyors, screw conveyors and bucket elevators to provide the clients with the most suitable solution. At inlet and outlet chutes we can install de-dusting systems as well.

Daniel Marshall – Martin Engineering

From the moment the material enters the transfer chute to being discharged, and all along the return belt path, Martin Engineering mitigates the main causes of dust emissions by fully controlling material flow. Our enclosed and sealed modular loading system is designed to control dust. With a supported belt edge and a tight dust seal, we engineer enclosures that are big enough and long enough to control airflow and let the dust settle. Martin’s belt tracking and cleaning solutions significantly reduce spillage and carryback, some of the main causes of dust.

CJ Ferguson – Richwood

Richwood recognises the need for a comprehensive dust and spillage containment strategy. Their method is based on an engineered, passive approach to dust containment. This passive method adheres to CEMA guidelines for transfer areas and industry best practices in containment.

It also avoids the common drawbacks found in traditional methods of dust suppression such as misting or spraying; either with water or chemicals or dust collection systems that require filters or continued maintenance.

There are no short cuts in a Material Containment System. A total analysis of a belt transfer must be carried out, paying close attention to every detail. Starting at the belt profile, the belt elevation must be established and maintained by underlying belt support. Belt speed, drop heights, material size and weight, along with output capacity are to be considered. Where the load is being introduced onto the receiving belt (impact zone), close attention must be paid to material restrictions in the transfer design, such as less than standard throat width opening of the skirtboards (industry standard is $^{2}/_{3}$ belt width), diverters or any other restriction that effect material flow. Skirtboard length beyond the impact zone must be noted and extended at times. If dust contamination/loss is a concern this must be outlined and addressed. In summary, a thorough review of the application must take place before any recommendations are made.

After review, the first step to successful containment is properly established belt elevation. According to CEMA standard 575, the belt should be fully transitioned with properly fitted transition idlers before entry into the impact bed. Full trough transition design is recommended.

Next, proper belt support must be in place. For Richwood, that includes Impact Saddles® and Cushion Arc® idlers in the load zone for impact protection and a proper foundation for successful sealing.

For bulk material containment, Canoe Liners® are put in place inside skirtboards. This provides wear resistance for abrasive materials and the first line of defense against spillage.

A secondary external sealing layer is then added to the skirtboards using a skirt rubber clamping system and a premium skirting rubber. All components are designed for ease of use that facilitates well-maintained work areas.

Lastly, for complete dust control, a fully covered dust stilling system is added with multiple dust stilling chambers and dust curtains that allow the dust to settle before it leaves the load zone. The passive dust containment system eliminates the need for vacuums, filters, misting or spray systems or other additional equipment.

The simplicity of the system eliminates the issues of traditional methods and provides a practical, low maintenance solution to a common issue wherever there is material in motion.

What steps can operators take to extend conveyor belt life?

Tobias Mehringer – Bühler Group

Operators are pivotal in extending conveyor belt life through proactive maintenance, effective cleaning practices, and operator training to minimise stress on the system. Adhering to recommended load capacities, maintaining optimal operating temperatures, correcting belt tracking, and investing in high-quality belts further contributes to longevity and enhanced operational efficiency. Prioritising these measures collectively ensures prolonged conveyor belt life and minimises downtime.

Rob van Oijen – Fenner Dunlop

In addition to having a good quality conveyor belt in the first place, regular, preventive maintenance, good quality components such as idlers and rollers, and a clean working environment are all essential factors that help to extend conveyor belt life. Other factors include making sure that any scrapers that are fitted are correctly adjusted and drum linings (where applicable) are in good condition. Belt tracking is also important because a mis-tracked belt can limit belt life and contribute to uneven wear. The primary cause of mis-tracking is often found to be material build-up on the bottom side of the conveyor belt or drums and pulleys.

Another key element is to have the correct belt specification matching the conveyor design. Unsuitable belt types may behave badly and limit its life span. Quality belt suppliers will have engineers to verify belt selection when provided with sufficient information on the conveyor design and material properties.

Davide Gambarotta – Gambarotta Gschwendt

Very good and periodic maintenance as well as using original spare parts are crucially important to avoid any machine breakdown and hence costs.

Gambarotta Gschwendt has access to a supply of spare parts and qualified technicians all over the world, for on-site assistance on machines manufactured by the company or lifting and hauling machines by other manufacturers.

What can operators do to minimise conveyor lifecycle costs?

Tobias Mehringer – Bühler Group

Bühler advises to always follow the specific maintenance plan for the conveyor and to only use certified methods and materials. Furthermore, we offer a sensor package – including a retrofit – that greatly helps to identify a machine failure before it happens. Through this, your machine is protected from further damage that would lead to larger repair and downtime costs. Also it can happen that conveyors run longer than they need to, which leads to more wear and tear, so it is always advisable to keep an eye on the runtimes.

Rob van Oijen – Fenner Dunlop

The best way to minimise conveyor lifecycle costs is to choose belts based on their durability, suitability and longevity (whole life cost) rather than for short-term 'economic' or budgetary motives. It really is as simple as that. Experience shows, without doubt, that the price of the belt will invariably be reflected in both its quality of performance and the length of its operational life. The 'lower labour costs' argument that some use to explain extremely low prices is a fallacy because the labour element accounts for as little as 5% of the production cost. By comparison, raw materials make up some 70% of the cost of producing a conveyor belt so the only way to make a low-price belt is to use low-price (low grade), unregulated raw materials such as carbon black made by burning old car tyres, minimising or completely omitting key additives (such as antiozonants to prevent ozone & UV damage) in the rubber and using low-grade inner synthetic plies.

From an operational view, most belts are left to do their job once installed. However, it is vital to 'walk the conveyor' on regular basis, checking for broken parts or other irregularities. Very often external influences like broken idlers or scrapers, material build-up on pulleys, or belt lodged behind skirting or blocked material cause damage and premature failure, which could be avoided with regular inspections.

Daniel Marshall – Martin Engineering

Specially designed impact cradles support the belt and reduce the damage belts take in the punishing loading environment. Martin ensures the belt remains tracked so it does not come in contact with the conveyor structure which helps to retain good belt health and prevent fires.

What conveyor components typically require the most maintenance?

Tobias Mehringer – Bühler Group

For all conveyor types, tensioning the belt or chain at set intervals is the most important and therefore time-consuming task, if the conveyor does not have an automatic tensioning station. After that, one should regularly check the bearing and parts that are connected to bearings – like roles and drums – as well as conveyor casings that experience a lot of friction during their lifetime. Investing that time as part of the inspection will reduce the risk of a machine failure in the long run.

Rob van Oijen – Fenner Dunlop

Although not actually a key component, cleaning is typically what is most important. By keeping components clean, they require less maintenance whilst functioning as intended. Speaking first and foremost as a conveyor belt man and looking at the belt itself, it is estimated that splice joint problems account for some 80% of unplanned stoppages to carry out repairs. The cost of such repairs and the cost of lost output is considerable. But this should not be necessary at all. In my experience, the biggest causes of splice problems are shortcomings in the quality of the conveyor belt itself, the materials used to join the belt and the quality of the workmanship.

For example, poor rubber grade and poor adhesion between the inner plies, both of which are common faults found in the low-grade 'economy' belts can make the job difficult even for the most skilled splicer. The cost of splice joint repairs and the associated lost output should both be included when calculating the whole life cost of a conveyor belt. As the old saying goes, price is what you pay but cost is what you spend.

Davide Gambarotta – Gambarotta Gschwendt

Support bearings are the components that need the most maintenance. Periodic lubrication is necessary to avoid any foreign body to enter the bearing. Furthermore, it is important to constantly check the chain or belt tension.

Daniel Marshall – Martin Engineering

Covid had a profound impact on the bulk handling industry as many people retired and the industry has struggled to find replacements. This has raised the need for servicing contracts with equipment manufacturers and contractors. Without the properly trained internal staff, we have observed that the general maintenance of components such as idlers – keeping the bearings greased, etc. – have led to situations where idlers fail all at once which requires excessive unscheduled downtime to fix. Rubber seals and urethane belt cleaners wear away without proper maintenance causing dust and spillage along the entire belt path.

Which aspects of managing a conveyor installation are most frequently overlooked by operators?

Tobias Mehringer – Bühler Group

The oversights we observed were mainly in three different categories. Firstly, a system used in a different way than originally planned – for example, conveying a different kind of commodity or a change in the property of the commodity, such as dampness. Secondly, too few inspection or maintenance actions like proper lubrication or re-tension of the belt or chain. And thirdly, not following a proper safety protocol like Lock-Out Tag-Out can not only damage the machine but, more importantly, cause harm to the people working on it.

Rob van Oijen – Fenner Dunlop

In my experience it is regular inspection of the whole conveyor system that is most frequently overlooked by operators. Regular 'up-close' inspections are essential in order to identify and correct problems as soon as they appear. In this case, my doctrine is simple: "It is not what you expect, it is what you inspect."

Davide Gambarotta – Gambarotta Gschwendt

Most of the time our technicians find some common issues while on-site that occurred during a conveyor installation. These are due to the fact the operators did not follow our step-by-step installation procedure that is provided along with the equipment maintenance and operational manual. For this reason we always suggest to our clients that they should carry out the installation and commissioning together with our skilled team, on-site or through remote meeting assistance.

Daniel Marshall – Martin Engineering

Diverting labour from important tasks to clean up under conveyors and clear walkways is not just expensive, it lowers safety and morale. According to OSHA/MSHA records, incidental contact during cleaning up around a moving conveyor is a significant and serious workplace safety issue that too often leads to limb loss and death. Preventing spillage and carryback from piling under the system has a positive impact on workplace safety and lowers the cost of operation. Guarding around the conveyor is also extremely important.

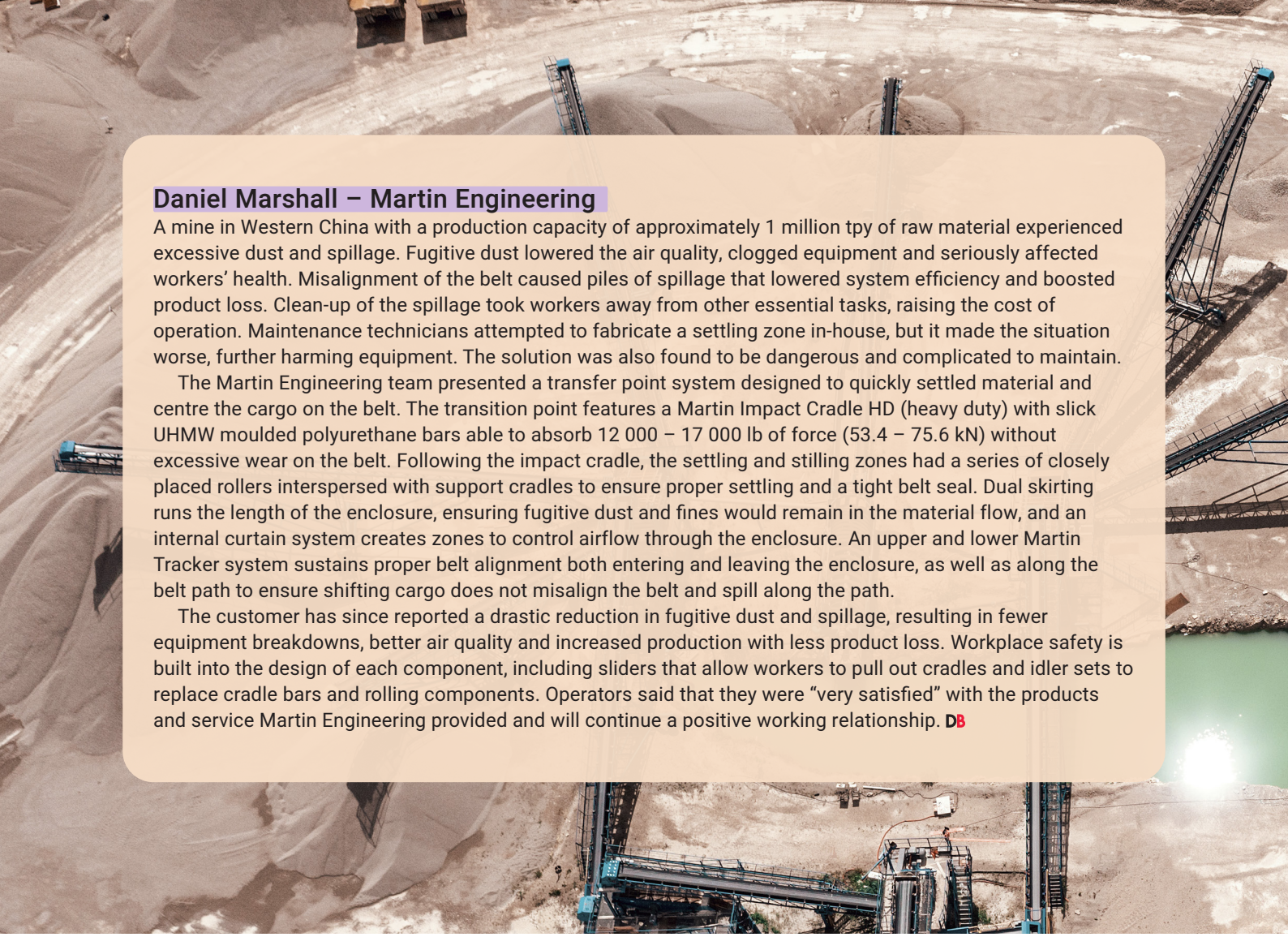
Provide a recent case study of a conveyor installation at a port, terminal, or mine.

Tobias Mehringer – Bühler Group

One success story involves COFCO International's Timbúes facility in Argentina. COFCO is a global food provider specialising in grains, oilseeds, and sugar, and invested in Bühler's enclosed belt conveyor system. COFCO emphasises our equipment quality, robustness, and reliability as being crucial for a continuous process plant. The decision was prompted by Argentina's stringent food hygiene and safety regulations, specifically regarding dust presence. Our enclosed belt conveyors, equipped with spot filters, not only meet hygiene standards but also enhance plant safety by minimising suspended dust and reducing explosion risks.

Davide Gambarotta – Gambarotta Gschwendt

To minimise material leakage at port terminals, we have recently designed Gambarotta Gschwendt Eco-Hoppers, which minimise material dust leakage during the unloading process. This means there is no material wastage and no pollution too, thus leading to a new eco-friendly approach. The Eco Hopper's capacity can be designed up to 200 m^3 with a loading capacity to the truck of up to 1500 tph. The Eco Hopper can also be designed with rubber tires or rail bogies.



Daniel Marshall – Martin Engineering

A mine in Western China with a production capacity of approximately 1 million tpy of raw material experienced excessive dust and spillage. Fugitive dust lowered the air quality, clogged equipment and seriously affected workers' health. Misalignment of the belt caused piles of spillage that lowered system efficiency and boosted product loss. Clean-up of the spillage took workers away from other essential tasks, raising the cost of operation. Maintenance technicians attempted to fabricate a settling zone in-house, but it made the situation worse, further harming equipment. The solution was also found to be dangerous and complicated to maintain.

The Martin Engineering team presented a transfer point system designed to quickly settled material and centre the cargo on the belt. The transition point features a Martin Impact Cradle HD (heavy duty) with slick UHMW moulded polyurethane bars able to absorb 12 000 – 17 000 lb of force (53.4 – 75.6 kN) without excessive wear on the belt. Following the impact cradle, the settling and stilling zones had a series of closely placed rollers interspersed with support cradles to ensure proper settling and a tight belt seal. Dual skirting runs the length of the enclosure, ensuring fugitive dust and fines would remain in the material flow, and an internal curtain system creates zones to control airflow through the enclosure. An upper and lower Martin Tracker system sustains proper belt alignment both entering and leaving the enclosure, as well as along the belt path to ensure shifting cargo does not misalign the belt and spill along the path.

The customer has since reported a drastic reduction in fugitive dust and spillage, resulting in fewer equipment breakdowns, better air quality and increased production with less product loss. Workplace safety is built into the design of each component, including sliders that allow workers to pull out cradles and idler sets to replace cradle bars and rolling components. Operators said that they were "very satisfied" with the products and service Martin Engineering provided and will continue a positive working relationship. DB