White Paper – New Generation Conveyor Skirting

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ABSTRACT For decade's rubber has been skirting the transfer points of conveyors worldwide. (SBR) Styrene- Butadiene Rubber's high wear resistance, combined with low cost, has made it a logical choice to date. With safety now being the driving force behind innovation and the risk of silicosis apparent, the demand for highly abrasive resistant skirting material is rapidly multiplying. Along with a reduction in employee complacency relating to working environments, higher belt speeds and skills shortage influencing the dramatic change. Today a strain of the high-performance plastic polyurethane is now the most economical way of skirting rubber conveyor belts. This paper analyses the Co-efficient of friction, wear resistance and tensile strength comparing SBR rubber, Natural Rubber, and Polyurethane.

1. INTRODUCTION

Above production rates and maintenance costs, the health and safety of company employees is now the number one priority. In many bulk materials handling plants, reducing the dust from conveyor transfer points subsequently reduces the risk of an employee's exposure to Silica dust. The litigation costs rivaling that of asbestosis costing billions of dollars.

Silicosis is a disabling, no reversible and sometimes fatal lung disease caused by inhalation of silica dust. Silica is the second most common mineral in the earth's crust and is a major component of sand, rock, and mineral ores. Overexposure to silica dust can cause scar tissue to form in the lungs, which reduces the lungs' ability to extract oxygen from the air we breathe.

Changing out or adjusting skirting on conveyors is a costly job for many bulk material plants across the globe. This is an issue affecting many aspects of business. Today administration time required for simple jobs like changing or adjusting skirting is extreme. Also a major problem for many plants is belt tracking which is often caused by material escaping from worn skirts.

With ever increasing production rates there is a greater requirement for plants to run 24 hours a day 7 days a week. In particular the power generation industry requires long run times between short scheduled maintenance windows. In many cases SBR rubber is not lasting the distance resulting in spillage, airborne dust, tracking issues, premature failure of idlers, belt damage etc.

There are many high wear resistant materials plants have available to combat wear such as ceramics, heat-treated or hardened steels. However, these materials can be unforgiving when used in skirting applications if run close to or contacting the conveyor belt surface.

The misunderstanding within the industry in distinguishing the difference between polyurethanes and polyethylene's and witnessing plants use materials such as old conveyor belt, Ultra high molecular weight polyethylene (UHMWPE), natural rubber etc, to skirt their transfer points prompted us to research the most economical and belt friendly skirting material available. Ruling out materials that were hard and or abrasive we chose 4 materials to analyse.

- SBR Rubber 60 DURO SHORE A (most commonly used)
- Natural Rubber 60 DURO SHORE A
- Linatex Natural Rubber 60 DURO SHORE A
- Argonics Polyurethan 69 DURO SHORE A

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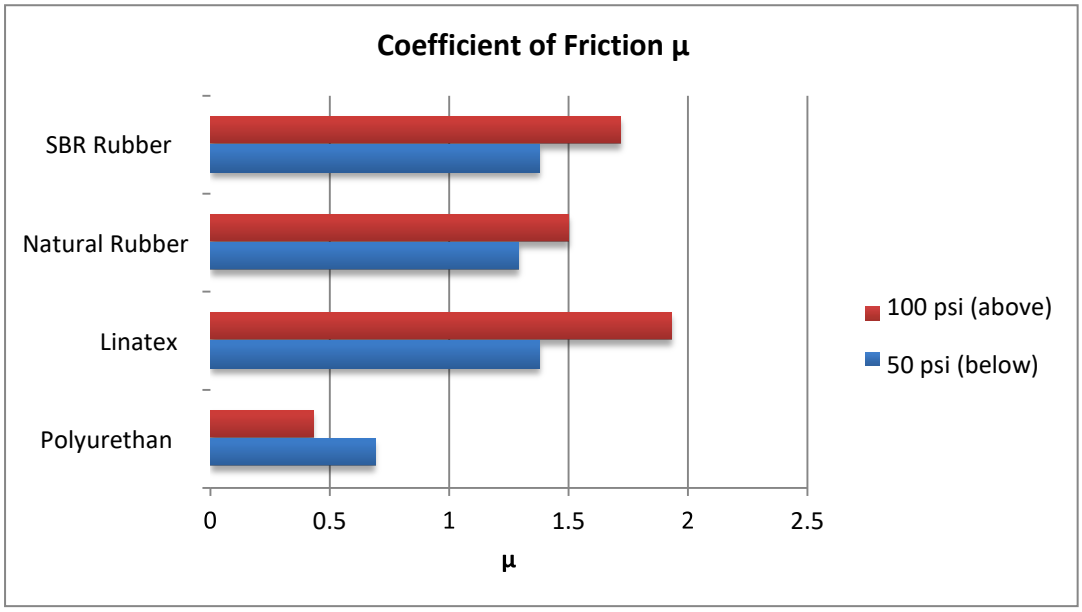
TEST RESULTS

FRICTION

The most important of the three tests due to its potential to transfer heat along skirted areas causing premature belt damage, is the skirting materials coefficient of friction value. In this case the lower the value μ the better.

Friction test: μ = tangent stress /normal stress

Normal Stress (psi)	Polyurethane	Linatex	Natural Rubber	SBR Rubber
50	0.69	1.38	1.29	1.38
100	0.43	1.93	1.5	1.72
Average (μ)	0.56	1.655	1.395	1.55



- **The polyurethane sample had the lowest friction value in all 4 tests.**
- **The friction value of Polyurethane is 64% lower than SBR rubber.**

The 200 and 300 psi test data was not graphed as the Linatex natural rubber samples pealed off twice due to excessive friction rates during testing.

Reducing friction between skirting and the conveyor belt surface is arguably the most important step in eliminating excessive skirting wear and belt damage. Conveyor belts are often replaced solely due to the skirting wearing a groove completely through the belts top cover exposing the ply carcass and results in tearing, spillage, belt tracking issues etc.

Some rubber skirting is porous which allows dust to adhere to the contact surface forming abrasive grit, which then wears a groove in the conveyor belt.

Polyurethane being nonporous restricts the amount of dust being trapped under the skirt's surface.

- **Rubbers high friction = High abrasion and belt damage.**
- **Polyurethane's low friction and non-porosity = Less abrasion and belt damage**

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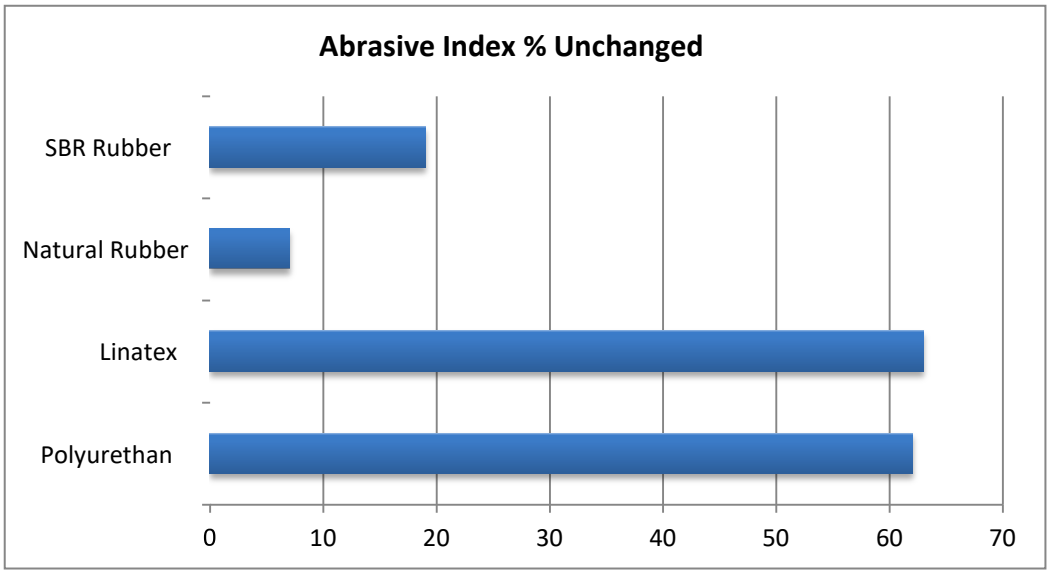
ABRASIVE RESISTANCE

Test Method: NBS Abrasion (ASTM D1630) Chemtura Laboratory test facility, USA

ABRASIVE INDEX	Argonics Polyurethane	Linatex (nat) Rubber	Natural Rubber	SBR Rubber
% unchanged	62	63	7	19



The above graph shows that Linatex natural rubber whilst achieving a high wear resistance is not preferred as a conveyor skirting material due to its high friction coefficient. Linatex was not used in a case study for this reason.

- **The graph shows the Polyurethane sample 326% more resistant to wear than SBR rubber.**

This should not be confused with the true wear resistance of the materials tested due to the field situation allowing for friction between the belt and the skirting.

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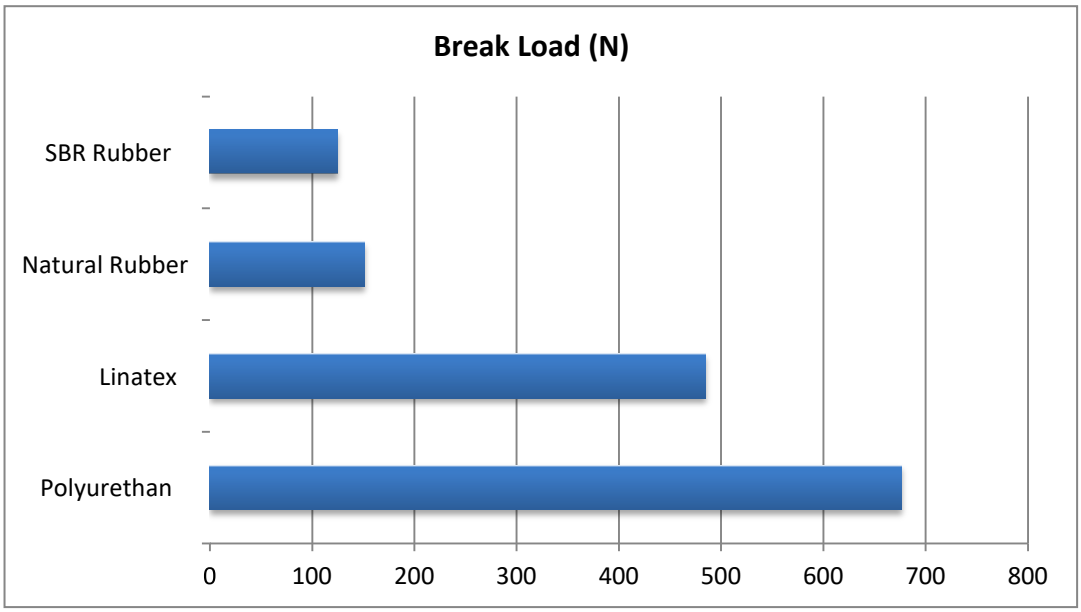
TENSILE STRENGTH

Test Method: Extensometer (strain gauge)

TENSILE STRENGTH	Argonics Polyurethane	Linatex (nat) Rubber	Natural Rubber	SBR Rubber
Break Load (N)	676	485	151	125



- **The above graph shows Polyurethane having the highest tensile strength.**

RESULTS COMPARED	Argonics Polyurethane	Linatex (nat) Rubber	Natural Rubber	SBR Rubber
Abrasion % of original	62	63	7	19
Friction (μ)	0.56	1.655	1.395	1.55
Tensile Strength (N)	676	485	151	125

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2. CASE STUDY

- **Gladstone Operating Port Authority, Gladstone, Queensland**

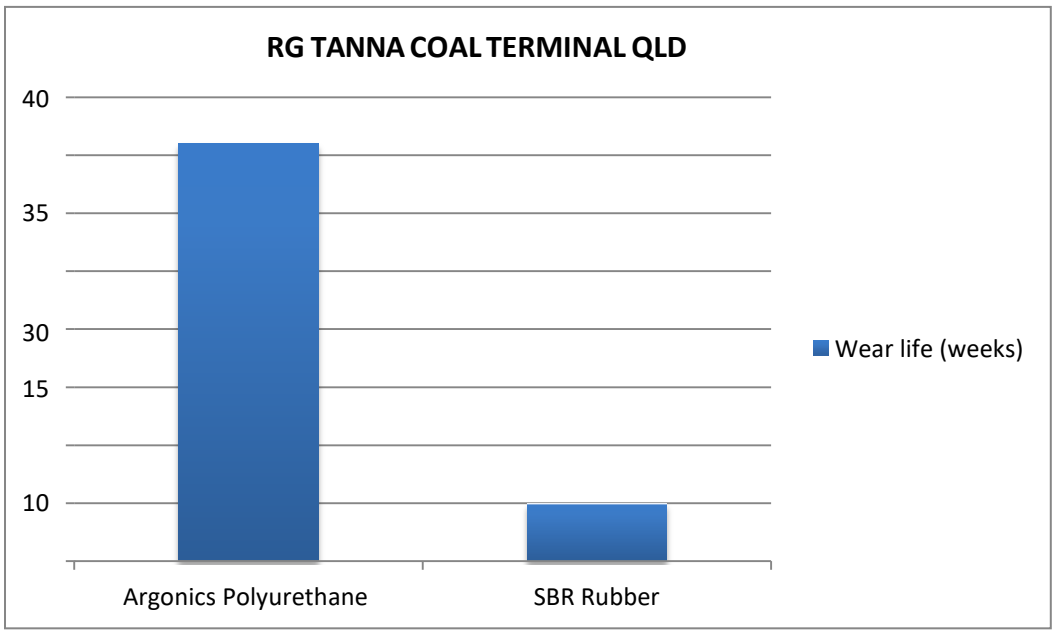
A trial was conducted at the RG TANNA Coal terminal to properly test the performance of polyurethane against the most commonly used skirting material SBR rubber. The conveyor transfer point from the wharf conveyor to the ship loader was chosen as the test area.

Conveyor 6B-6BX Transfer point specifications

- 6000 TPH
- 5.2 m/s
- 2400mm Rubber conveyor belt width

The polyurethane skirting was installed in Sept 2008 and was still very effective by June 2009 Reported: 11th June 2009 only 1.5mm wear present.

Skirting material	Argonics Polyurethane	SBR Rubber
Wear life (weeks)	36	5



- **The graph shows the polyurethane skirting outlasting the SBR rubber by at least 6 times.**

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4. CONCLUSIONS

High wear resistance combined with a low coefficient of friction is the ideal combination for a skirting material. Polyurethane produced the best results in the laboratory and field tests. Though the abrasive test results show polyurethane is 3-4 times more abrasive resistant than SBR rubber, however once the friction factor was added in a real world scenario, we concluded that the polyurethane lasted 6-10 times longer than SBR rubber. This difference in wear rates is due to the polyurethanes very low friction value. The abrasive resistance test ASTM D1630 simulates abrasion by means of grit and not the contact between the conveyor belts.

Further case studies have showed that as the belt speed increased the wear rate of SBR rubber increased exponentially. However, polyurethane remained more constant due to the lower friction value.

The table below summarises the suitability of each tested material.

	Argonics Polyurethane	Linatex Natural Rubber	Natural Rubber	SBR Rubber
High wear resistance?	YES	YES	NO	NO
Low Friction?	YES	NO	NO	NO
Suitable for high belt speed?	YES	NO	NO	NO

ACKNOWLEDGEMENTS

The author would like to thank the Gladstone Port Authority (RG TANNA COAL TERMINAL) for making themselves available for the trial to take place on site.

5. NOMENCLATURE

TPH	Tonnes per hour	N	Newtons
Psi	Pounds per square inch	μ	Coefficient of friction
SBR	Styrene-Butadiene Rubber	m/s	Meters per second
ASTM	American Society for Testing and Materials		

6. REFERENCES

(1) Greg Case, Gladstone Port Authority, Gladstone QLD

(2) Reglin Suppliers, Kilysyth, Victoria

(3) Chemtura, Middlebury, Connecticut, USA

(4) Neil Kinder, Kinder Australia Pty Ltd

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