Conveyor Belting for Underground Use

April 2006
AGENDA

1. Comparisons PVC vs Rubber
2. Alternatives - Carcass Designs
3. Risks - Toxicity - Smoke - Fire
4. Standards - SANS
5. Other Countries
   - ISO430
   - MSHA
   - MT668-1997/MT450-1995
   - DIN22131/DIN22120
PVC Belting -- Sales Strategies

• No Ply Separation
• No Edge Fraying
• Lower Initial Cost
• Can Meet Proposed SANS 971 Tests
• Long Life Cycle?
Rubber & PVC Comparison

Advantages of Rubber

• Rubber wears 60% better than PVC
  • extended belt life
  • operational cost savings

• Rubber covers can exceed PVC’s cover gauge limitation of 3-mm
  • extends belt life
  • reduces cost per ton
Rubber & PVC Comparison

Advantages of Rubber

• Rubber belt carcass weighs less
  • lower kN-rating requirements
  • lower kW requirements

• Rubber multi-ply is easier to vulcanize
  • lower maintenance cost
  • reduced downtime
Rubber & PVC Comparison

Advantages of Rubber

• Rubber covers are easier to clean
  • reduced idler wear
  • reduced wear on scrapers & covers

• Rubber’s lower Durometer
  • reduced idler wear
  • reduced noise
Rubber & PVC Comparison

Coefficient of Friction

• Rubber has a greater coefficient of friction

• Increases idler life 3 to 5 times - due to added gripping action

• Reduces the chances of drive slippage

• Increases trainability by allowing idlers to exert greater steering forces
INITIAL PURCHASE COST COMPARISON
Class 1250 3 x 2 mm Covers

Cost Index

PVC Nitrile  |  Rubber current SABS 971
100         | 155
## Cash Flow Forecast Assumptions

<table>
<thead>
<tr>
<th>Item</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conveyor Length</td>
<td>C-C 2000 M</td>
</tr>
<tr>
<td>Annual Tonnage</td>
<td>5 Million tons</td>
</tr>
<tr>
<td>Cost escalation</td>
<td>8% per annum</td>
</tr>
<tr>
<td>Discount Rate</td>
<td>20% per annum</td>
</tr>
<tr>
<td>Calculation period</td>
<td>12 Years</td>
</tr>
<tr>
<td>Installation &amp; Removal costs</td>
<td>includes transport, splicing, commissioning.</td>
</tr>
<tr>
<td>Costs common to all products</td>
<td>such as maintenance, inserts, joint</td>
</tr>
<tr>
<td></td>
<td>replacement and scrapers are excluded.</td>
</tr>
<tr>
<td>3x2 mm covers roll length</td>
<td>250 m / 6x2 mm covers roll length 200 m</td>
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</table>
NET PRESENT COST COMPARISON

<table>
<thead>
<tr>
<th>Material</th>
<th>NPC</th>
<th>PVC Nitrile 3x2 mm</th>
<th>Rubber current SABS 971 3x2 mm</th>
<th>Rubber current SABS 971 6x2 mm</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>5.8</td>
<td>6.6</td>
<td>4.2</td>
<td></td>
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</tbody>
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- PVC Nitrile 3x2 mm
- Rubber current SABS 971 3x2 mm
- Rubber current SABS 971 6x2 mm
CASH FLOW FORECAST
PVC Nitrile 1200mm C1250 3x2 mm
Useful life 12 - 15 M tons

<table>
<thead>
<tr>
<th>Years</th>
<th>Inst &amp; Removal</th>
<th>Belt Cost</th>
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<tbody>
<tr>
<td>Y0</td>
<td>0.27</td>
<td>1.92</td>
</tr>
<tr>
<td>Y1</td>
<td>0.34</td>
<td>2.42</td>
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<tr>
<td>Y2</td>
<td>0.43</td>
<td>3.05</td>
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<tr>
<td>Y3</td>
<td>0.54</td>
<td>3.84</td>
</tr>
</tbody>
</table>

R' Mil
CASH FLOW FORECAST
Rubber current SABS 971 C1250 3x2 mm
Useful life 18 - 20 M tons

![Graph showing cash flow forecast with data points for Years Y0 to Y9 and columns for Inst & Removal and Belt Cost. The values are as follows:
- Inst & Removal: Y0 = 0.21, Y1 = 0.29, Y2 = 0.40
- Belt Cost: Y0 = 2.98, Y1 = 4.05, Y2 = 5.51]
CASH FLOW FORECAST
Rubber current SABS 971 C1250 6x2 mm
Useful life 40 - 42 M tons

<table>
<thead>
<tr>
<th>Years</th>
<th>Inst &amp; Removal</th>
<th>Belt Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y0</td>
<td>0.21</td>
<td>2.97</td>
</tr>
<tr>
<td>Y1</td>
<td>0.40</td>
<td>5.49</td>
</tr>
<tr>
<td>Y2</td>
<td>0.00</td>
<td>-2.75</td>
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Alternatives – Carcass Designs

Industry Standard Construction
“Multi-Ply” Design

Alternative Construction
“Straight”-Warp

Conquest™
(Triple-Warp™)
Triple-Warp™ Fabric

Fill Cords  
Binder Warps  
Surface Warps  
Straight Warps  
“Team” or “Bundle”
Note(s):
* Multi Ply test belt: 4/800
* 1” bullet head was used with 207 lb mass drop Height (in.)
Note:
* Multi Ply test belt: 4/800
Risks – Toxicity - Smoke

PVC
Drum Friction Video

Rubber Multiply
Drum Friction Video
Risks – Fire Hazard Assessment

- Function of Belt characteristics
- Function of Belt Installation & Operation
- Environment - Wide range of Applications
- No Single Test will give full Assessment
- Interrelated Factors need to be Considered to access Fire Hazard for Each Situation
- Degree of Fire Hazard Varies from Extreme to Remote
Standards - SANS 971

• SANS 971 does not distinguish whether a hazardous or non-hazardous application or allow change to classification through introduction of additional safety measures.
  – Additional safety measures would include environmental controls, such as smoke detectors, CO monitors or fail to safe instrumentation.
Standards - SANS 971

• SANS 971 has not evaluated the toxicity of burning belts, or whether belts that have been in operation, still meet the original tests.

• SANS standards have not explored whether the Drum Friction test replicates underground belt conveyors in real life because simulation excludes pulley lagging.
Comparison of SABS 971 to Practices in Other Countries

• SABS 971
  – Cover on test
  – Cover off test
  – Drum friction test

• MSHA
  – No drum friction test
  – No cover off test

• DIN 22103
  – No drum friction test
Practices in Other Countries

• **Australia – China**  
  Three Compounds Type S, F and E

• **Five Tests Applied to Determine Degree of Fire Resistance**  
  1. Gallery Test  
  2. Small Scale Fire test  
  3. Drum Friction Test  
  4. Electrical resistance  
  5. Oxygen Index ISO4589
CONCLUSION
Any Questions?