Measurement and correction of baggy edges on paper machines

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FPInnovations
Outlines

- A few words on baggy edges
- Available tools to evaluate baggy edge
- Case studies: correction of baggy edges
- Conclusions
A few words on baggy edges
What is web tension non-uniformity in CD?

Baggy edge
= lack of tension
= tension drop
= longer web
= slack edge
Etc.
Issues related to baggy edges

- Print quality problems
- Misregistration
- Wrinkles/crepe wrinkles
- Web breaks
- Poor splicing
- Poor winding
- Web defects such as calender cuts, crepe wrinkles, etc.
Baggy edge rolls cause web weaving

![Image of web weaving](image)

**Lateral oscillations vs CD position**

<table>
<thead>
<tr>
<th>Position</th>
<th>Stdev of median position (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0.2</td>
</tr>
<tr>
<td>B</td>
<td>0.1</td>
</tr>
<tr>
<td>Y</td>
<td>0.15</td>
</tr>
<tr>
<td>Z</td>
<td>0.25</td>
</tr>
</tbody>
</table>

Baggy edge rolls
Baggy edge rolls also cause misregistration

Roll median position stability on T12

- Before printing
- After printing

<table>
<thead>
<tr>
<th>Roll 1</th>
<th>Roll 2</th>
<th>Roll 3</th>
<th>Baggy roll</th>
<th>Roll 5</th>
<th>Roll 6</th>
<th>Roll 7</th>
<th>Roll 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.10</td>
<td>0.15</td>
<td>0.20</td>
<td>0.35</td>
<td>0.10</td>
<td>0.15</td>
<td>0.20</td>
<td>0.35</td>
</tr>
</tbody>
</table>

Magenta
Cyan
Baggy edge rolls even cause web breaks!

High tension = Risk of break

Bagginess zone

Increasing the average tension to reduce the bagginess on press
Origin of bagginess

Longer Spring?
= Local Stretch
= Bagginess

Bigger or smaller Spring?
No Bagginess
MD/CD ratio profile

Edge roll shrinkage effect

Edge rolls usually have more expansion or shrinkage, leading to web elongation and bagginess at the edges.
Existing tools to evaluate baggy edge
Some mills try to relate baggy edge to roll hardness
Other mills try to relate baggy edge to TSI MD

<table>
<thead>
<tr>
<th>TSI MD</th>
<th>kNm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean V.</td>
<td>7.581</td>
</tr>
<tr>
<td>Std Dev.</td>
<td>0.1798</td>
</tr>
<tr>
<td>Min</td>
<td>7.001</td>
</tr>
<tr>
<td>Max</td>
<td>7.875</td>
</tr>
<tr>
<td>No Val</td>
<td>166</td>
</tr>
</tbody>
</table>

(should be less than 10%)
Existing tools to quantified baggy edge on machine

Beam with air pressure sensors that measure air pressure between paper and beam

Roll with a film force sensors mounted on it in a helical arrangement

Both pictures have been taken from Metso publications and internet site.
Off-line tension beam to quantify baggy edges

- High accuracy (5% error)
- High resolution in CD (every 1”)
- Width 50”
Beam installation on roll tester equipment

- Wound-out-tension
- Paper rolls
- Lateral oscillations
- CD Tension
- Measurex scanner
- Diameter, roundness and length
High resolution measurements in CD

**Tension profiles of paper with baggy streaks - SCA paper**

- CW
- CCW

**Tension profiles of dried edges paper - newsprint**

- CW
- CCW
Roll comparison from different CD positions

Rolls tension profile

Worst Roll for Bagginess
Case studies: correction of baggy edges
Case study #1: Baggy edge (newsprint)

Significant baggy edge at the back of the machine
Case study #1: Correcting the drying history

Changing the drying history (press + dryers) allowed to reduce the tension non-uniformity at the back edge
Case study #2: Baggy edge (directory grade)

CD tension profile (STD production)

Significant baggy edge at both edges of the machine
Case study #2: Application of moisture bias

Moisture bias at the edges

Moisture bias
(-2% gradual bias over 50” wide)

Tension profile in CD increases at the edges

Tension profile with moisture bias -2% - Back of PM1
Case study #2: Correcting the tension profile with moisture bias

- No bias
  - The tension profiles were not uniform at the edges

- With bias
  - Tension profiles are improved, especially at the back
Case study #3: Inverse baggy edge (fine paper)

Inverse baggy edges at each edge of the machine
The customers see baggy edges
Case study #3: Correcting CD moisture profiles

Inverse correlation between CD tension and CD moisture profiles (higher moisture = lower tension)

Correction of CD moisture profiles is underway
What can be achieved

✓ Measurements on any grade of paper
  ★ Base sheet/coated/laminated
  ★ After conversion/print
  ★ Different CD positions and sets on paper machines

✓ Quantification of CD tension profile
  ★ Quantify how severe is actual bagginess
  ★ Comparison with database

✓ Corrections suggested

✓ Analysis and follow-up of machine changes
Conclusions

• A tension beam was developed to quantify CD tension profile of paper web
  • high accuracy (<5% error)
  • high resolution (50 units over 127 cm width)
• This new tool was successful in measuring the tension non-uniformity of different types of paper grades.
• Bagginess and baggy edge can now be quantified at low cost
• Corrections can be made by changing the drying history of the web from the press section to the reel.
• The tension beam can be used to monitor the tension profiles corrections and later to ensure the uniformity of the profiles with time.