Benchmarking Sawmill Recovery:
Trends in Sawmill Efficiency over the Years and by Region

Timber Measurements Society
Central Meeting
Portland, OR

Roy Anderson, PhD
April 2017
Agenda

- What is recovery?
- Why recovery?
- Measuring recovery
- Factors affecting recovery
- Financial impacts of recovery
- Recovery data by region
What is Recovery?

“...the amount and type of lumber recovered out of a given quantity of logs...”

## Why Recovery?

**Beck Group Industry Benchmarking Results ($/MBM)**

<table>
<thead>
<tr>
<th></th>
<th>2013 Western Dimension</th>
<th>2012 SYP</th>
<th>2013 Western Studs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales realization</td>
<td>421</td>
<td>332</td>
<td>379</td>
</tr>
<tr>
<td>Log Costs</td>
<td>255 67%</td>
<td>170 57%</td>
<td>202 60%</td>
</tr>
<tr>
<td>Conversion Costs</td>
<td>128 33%</td>
<td>129 43%</td>
<td>133 40%</td>
</tr>
<tr>
<td>Total Cost</td>
<td>383 100%</td>
<td>299 100%</td>
<td>335 100%</td>
</tr>
<tr>
<td>EBIT</td>
<td>38</td>
<td>33</td>
<td>44</td>
</tr>
<tr>
<td>EBITDA</td>
<td>49</td>
<td>45</td>
<td>58</td>
</tr>
</tbody>
</table>

Logs are the biggest component of cost!
Measuring Recovery:

1. Recovery:
   Volume of Lumber
   per
   Board Foot of Logs

2. Yield:
   Weight of Logs
   per
   Volume of Lumber

Some regions scale logs on a cubic volume basis so lumber recovery expressed as percent of cubic log volume. Recovery also sometimes called Overrun, or LRF. None of other methods or terms addressed in this presentation.
Measuring Recovery: Lumber Volume

• May be gross lumber volume (*sawmill output*)
• May be lumber volume net of trim loss (*shippable volume*)
• May or may not include “shorts” sales volumes
Factors Affecting Recovery

• Log mix
• Lumber target size
• Saw kerf
• **Lumber product mix**
• Technology/optimization
• Operator decisions
# Product Mix and Recovery

## Lumber Product Net vs. Nominal Volume

<table>
<thead>
<tr>
<th>Nominal Thickness</th>
<th>Nominal Width</th>
<th>Rough Green Target Thickness</th>
<th>Nominal Width</th>
<th>Nominal Bf/Lf</th>
<th>Nominal Bf/Lf</th>
<th>Nominal Net Bf/Lf</th>
<th>Nominal Net Bf/Lf</th>
<th>Difference Bf/Lf</th>
<th>% Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>4</td>
<td>1.699</td>
<td>3.843</td>
<td>0.667</td>
<td>0.547</td>
<td>0.120</td>
<td>18.4%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>6</td>
<td>1.699</td>
<td>5.870</td>
<td>1.000</td>
<td>0.834</td>
<td>0.166</td>
<td>16.9%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>8</td>
<td>1.699</td>
<td>7.751</td>
<td>1.333</td>
<td>1.097</td>
<td>0.236</td>
<td>17.7%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>10</td>
<td>1.699</td>
<td>9.799</td>
<td>1.667</td>
<td>1.387</td>
<td>0.279</td>
<td>16.8%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>12</td>
<td>1.699</td>
<td>11.865</td>
<td>2.000</td>
<td>1.680</td>
<td>0.320</td>
<td>16.0%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>3.848</td>
<td>3.848</td>
<td>1.333</td>
<td>1.234</td>
<td>0.096</td>
<td>7.2%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>4</td>
<td>0.988</td>
<td>3.861</td>
<td>0.333</td>
<td>0.318</td>
<td>0.015</td>
<td>4.6%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>6</td>
<td>0.988</td>
<td>5.892</td>
<td>0.500</td>
<td>0.485</td>
<td>0.015</td>
<td>3.0%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# Product Mix and Recovery

## January Market

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Price per Nominal BF</th>
<th>Price per Net BF</th>
</tr>
</thead>
<tbody>
<tr>
<td>2x4</td>
<td>375</td>
<td>459</td>
</tr>
<tr>
<td>2x6</td>
<td>325</td>
<td>391</td>
</tr>
<tr>
<td>2x8</td>
<td>300</td>
<td>364</td>
</tr>
<tr>
<td>2x10</td>
<td>355</td>
<td>426</td>
</tr>
<tr>
<td>2x12</td>
<td>365</td>
<td>435</td>
</tr>
<tr>
<td>4x4</td>
<td>370</td>
<td>399</td>
</tr>
</tbody>
</table>

## June Market

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Price per Nominal BF</th>
<th>Price per Net BF</th>
</tr>
</thead>
<tbody>
<tr>
<td>2x4</td>
<td>375</td>
<td>459</td>
</tr>
<tr>
<td>2x6</td>
<td>335</td>
<td>403</td>
</tr>
<tr>
<td>2x8</td>
<td>320</td>
<td>389</td>
</tr>
<tr>
<td>2x10</td>
<td>375</td>
<td>450</td>
</tr>
<tr>
<td>2x12</td>
<td>400</td>
<td>476</td>
</tr>
<tr>
<td>4x4</td>
<td>450</td>
<td>485</td>
</tr>
</tbody>
</table>
Profit Sensitivity Analysis of Typical Northwest Sawmill

$0.35 $0.88 $2.53 $3.20 $3.87

$0.00 $0.50 $1.00 $1.50 $2.00 $2.50 $3.00 $3.50 $4.00 $4.50

$/MBM

+1% Byproduct Values
+1% Productivity
+1% Log Cost
+1% Lumber Recovery
+1% Lumber Sales Realization

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Recovery: Log Cost Impact

- Improvements in lumber recovery reduce log cost on a lumber basis

- Example:
  - A mill has a delivered log cost of $650/MBF and a lumber recovery of 2.30. Log cost on a lumber basis is $283/MBM ($650/2.30 = $283)
  - The mill improves recovery by 2% from 2.30 to 2.35. This leads to a log cost on lumber basis of about $277/MBM ($650/2.35 = $277)
  - A reduction of about $6/mbm
  - For a mill producing 100 MMBM per year, the cost savings is $600,000
Recovery: Productivity Impact

• Recovery improvements can impact both the number of pieces of lumber and the average size per piece (wider and/or longer)

• If improvements are made via target size or saw kerf reduction, or improved optimization, most of gain will come in form of larger piece size

• Larger average piece size will improve mill productivity per hour

• More pieces can improve mill productivity if back end (trimmer, sorter, stacker) is not bottleneck
Recovery: Manufacturing Cost Impact

- Some manufacturing costs will increase as the volume of lumber produced increases (packaging, drying costs)
- Many manufacturing costs will remain the same (labor, overhead costs), resulting in decreased manufacturing costs per thousand board feet of lumber

Example:
- Through upgraded optimization, a mill improves lumber recovery by 2%, resulting in a 1% improvement in productivity per hour
- Of the mill’s $135/MBM total manufacturing costs, $115 are fixed (independent of volume) while $20/MBM for packaging, drying, and other costs are variable (will rise with production levels)
- Unit manufacturing costs are reduced by $1.15/MBM (1% x $115)
- Equal to $115,000 savings at a 100 MMBM/year mill
Lumber Sales Impact

• Improved recovery can result in more lumber sold – big impact on bottom line
  • Example:
  • Mill buys 50 MMBF logs/year @ 2.5 recovery = 125 MMBM lumber
  • 1% increase in recovery, but still buys 50 MMBF logs
  • Lumber production now equals 50 MMBF x 2.525 = 126.25 MMBM
  • “Extra” 1.25 MMBM x $350 = $437,500

• If recovery improvement comes at expense of quality/grade, average selling price may be negatively impacted
Byproduct Yield Impact

• Improved lumber recovery will often mean reduced chip yields
• Smaller green target sizes will result in reduced shavings yield
• Smaller kerf sizes will result in reduced sawdust yield
• Almost always “worth it” to produce less byproducts in exchange for producing more lumber
Changes in Lumber Recovery in U.S. South

Lumber Recovery (BF/Ton) vs. Log Diameter (Inches)

This is about a 0.9% improvement in recovery per year

\[ y = 1.7731x + 197.24 \]

Lumber Recovery

Average Bucked Log Diameter (in)

Linear (Lumber Recovery)
Changes in Lumber Recovery in Western Stud Mills (DF/Larch only)

This is about a 0.4% improvement in recovery per year
Changes in Lumber Recovery in Western Dimension Mills (DF/Larch only)

This is about a 1.4% improvement in recovery per year
Food for Thought???

- The amount of lumber recovered per unit of log volume has a fixed ceiling
- Are we there yet?