ENHANCING ECONOMIC COMPETITIVENESS THROUGH GOING GREEN – MINIMIZING PRODUCTION MATERIALS WASTE

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Why am I here today?

- Talk to you quickly about “Green Systems” that will drive future markets
- Introduce you to ways to minimize production waste and improve processing in the primary and secondary processing areas (+ some wood recovery opportunities)
- To tell you that I can spend more time with you on any topic presented at a later date
WHAT WILL BE COVERED TODAY ...

- The history of wood related and recovery/recycling R&D in Blacksburg
- Ways to think about minimizing production waste
- Wood products that fit “Green Systems”
- Sawmill topics – edging and trimming, curve sawing, thin kerf sawing, pallet cants & parts
- Touch on pallets – PDS, heat treating, trends
- Secondary processing – rough mill types, ROMI programs, finger jointing
- Wood recovery – reuse – recycling opportunities?
  - Construction waste
  - Pallets
  - Used decking
WE HAVE A HISTORY OF WOOD CONSERVATION R&D -- TO INCLUDE RECOVERY/REUSE/RECYCLING R&D

Why?
- To improve material utilization – rough mills, scanning, log sawing
- Reduced pressure on our timber (forests)
- Reduced pressure on landfills
- Smart things to do

Wood Product Areas
- Lumber, dimension, furniture, cabinets, flooring, etc.
- Used wooden pallets
- Used treated wood deck materials
- Home construction and wood waste
The history of wood related and recovery/recycling R&D in Blacksburg

Ways to think about minimizing production waste

Wood products that fit “Green Systems”

Sawmill topics – edging and trimming, curve sawing, thin kerf sawing, pallet cants & parts

Touch on pallets – PDS, heat treating, trends

Secondary processing – rough mill types, ROMI programs, finger jointing

Wood recovery – reuse – recycling opportunities?
  - Construction waste
  - Pallets
  - Used decking
Minimizing waste - Wood material cost is the largest element in manufacturing costs.

Minimizing materials is an opportunity to reduce the cost of goods sold.
What are the benefits of waste optimization?

- Enhanced value chain relations
- Smart risk management
- Improved financial performance
How do you attack waste in your operation?

Approach your operation using a simple waste prevention hierarchy.
Minimize waste

Produce what is needed

The remainder of the talk will address these things
WHAT WILL BE COVERED TODAY ...

- The history of wood related and recovery/recycling R&D in Blacksburg
- Ways to think about minimizing production waste
- **Wood products that fit “Green Systems”**
- Sawmill topics – edging and trimming, curve sawing, thin kerf sawing, pallet cants & parts
- Touch on pallets – PDS, heat treating, trends
- Secondary processing – rough mill types, ROMI programs, finger jointing
- Wood recovery – reuse – recycling opportunities?
  - Construction waste
  - Pallets
  - Used decking
Housing and building related “Green Systems”

Why “Green Systems”

- Why – because they are the major pushers of “Green Products” with customers – both residential or commercial

- LEED, NAHB, EarthCraft, Built Green, Vermont Builds Greener, etc.
Most of these programs push recycling, etc.
WOOD PRODUCTS THAT FIT “GREEN SYSTEMS”

- Local wood
- Engineered wood products
- Certified wood products thru Chain-of-custody manufacturers (lumber, OSB, flooring, cabinets, furniture, moldings, etc.)
- Products made from recycled material
- Finger jointed products
“Green” Products and “Green” Housing - Are Consumer Choices - Consumers are driving this market
You can join the movement or not, but the bottom line is you need to minimize production materials waste and reduce costs.
WHAT WILL BE COVERED TODAY ...

- The history of wood related and recovery/recycling R&D in Blacksburg
- Ways to think about minimizing production waste
- Wood products that fit “Green Systems”
- Sawmill topics – edging and trimming, curve sawing, thin kerf sawing, pallet cants & parts (FYI – most of this also applies to White Pine)
- Touch on pallets – PDS, heat treating, trends
- Secondary processing – rough mill types, ROMI programs, finger jointing
- Wood recovery – reuse – recycling opportunities?
  - Construction waste
  - Pallets
  - Used decking
3 Sawmill Edging & Trimming Study: Actual vs. Potential

- 10% Volume Loss
- 32% Value Loss
MILL EDGING AND TRIMMING PERFORMANCE

![Bar chart showing performance comparison for Mill A, Mill B, and Mill C. The chart displays actual and optimal performance levels for each mill.](image-url)
## Grade and Volume Increases

<table>
<thead>
<tr>
<th>Board Category</th>
<th>% of Boards</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sawmill A:</strong></td>
<td></td>
</tr>
<tr>
<td>1 (grade improvement)</td>
<td>67</td>
</tr>
<tr>
<td>2 (volume increase)</td>
<td>29</td>
</tr>
<tr>
<td>3 (grade and volume)</td>
<td>4</td>
</tr>
<tr>
<td><strong>Sawmill B:</strong></td>
<td></td>
</tr>
<tr>
<td>1 (grade improvement)</td>
<td>18</td>
</tr>
<tr>
<td>2 (volume increase)</td>
<td>46</td>
</tr>
<tr>
<td>3 (grade and volume)</td>
<td>36</td>
</tr>
<tr>
<td><strong>Sawmill C:</strong></td>
<td></td>
</tr>
<tr>
<td>1 (grade improvement)</td>
<td>19</td>
</tr>
<tr>
<td>2 (volume increase)</td>
<td>39</td>
</tr>
<tr>
<td>3 (grade and volume)</td>
<td>42</td>
</tr>
</tbody>
</table>
**What if we improved 2 in 10 Red Oak boards from 7 to 8 Bd Ft**

<table>
<thead>
<tr>
<th>Gain</th>
<th>400 Bd Ft / Shift</th>
<th>800 Bd Ft / 2 Shifts</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>100 M Bd Ft / Year</td>
<td>200 M Bd Ft / Year</td>
</tr>
</tbody>
</table>

Could Mean:  
- +$100,000  
- +$200,000

**The Mill**  
- 16 M Bd Ft / Shift  
- 4,000 M Bd Ft / Year

**Virginia Tech**  
**US Forest Service**
WHAT IF WE IMPROVED 1 IN 10 RED OAK BOARDS FROM 1C TO 1F

Gain  $550 / Shift  $137,500 / Year
      $1100 / 2 Shifts  $275,000 / Year

The Mill
8 Bd Ft / Board
16 M Bd Ft / Shift
4,000 M Bd Ft / Year
HARDWOOD EDGING AND TRIMMING TRAINER COMPUTER PROGRAM

Phil Araman, Earl Kline and Matt Winn
Edging and Trimming Decisions are Complicated

- Size of board
- Cuttings
- # of cuttings
- Species
- Grades
- $ value / grade
- Can be a matter of $\frac{1}{4}$" or $\frac{1}{2}$"
Edging and Trimming Decisions Are Complicated

- Equipment may not be properly aligned
- Lasers ...... saw blades
- Customer differences
  - Domestic market
  - Export market
- Operators are not trainer graders
<table>
<thead>
<tr>
<th>Grade</th>
<th>Value</th>
<th>Length</th>
<th>Width</th>
<th>Surface Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>#2COMMON</td>
<td>$1.76</td>
<td>9 ft, 1 in.</td>
<td>5.25 in.</td>
<td>4 ft</td>
</tr>
<tr>
<td>#1COMMON</td>
<td>$3.70</td>
<td>9 ft</td>
<td>6.00 in.</td>
<td>5 ft</td>
</tr>
</tbody>
</table>

**Optimum Cutting:**
- Grade: #1COMMON
- Value: $3.70
- Length: 9 ft
- Width: 6.00 in.
- Surface Measure: 5 ft
Unprocessed board

Length: 10 ft., 7 in.  
Width: 12.50 in.  
Surface Measure: 10 ft.

Optimal Solution

Grade: FAS 1Face  
Value: $12.24  
Surface Measure: 8 ft.

No Wane Solution

Grade: FAS  
Value: $7.70  
Surface Measure: 5 ft.
Unprocessed board

Length: 9 ft., 0 in.  
Width: 12.25 in.  
Surface Measure: 9 ft.

Optimal Solution

Grade: FAS  
Value: $10.78  
Surface Measure: 7 ft.

No Wane Solution

Grade: FAS  
Value: $7.70  
Surface Measure: 5 ft.
Unprocessed board

Length: 12 ft., 2 in.
Width: 11.00 in.
Surface Measure: 11 ft.

Optimal Solution

Grade: FAS
Value: $10.78
Surface Measure: 7 ft.

No Wane Solution

Grade: 1 Common
Value: $6.24
Surface Measure: 6 ft.
IN THIS MARKET USE THE NHLA GRADING RULES AS WRITTEN - LEAVE WANE
CURVE SAWING HARDWOODS

Phil Araman, USDA Forest Service

Brian Bond, Virginia Tech
CURVE-SAWING HARDWOODS TO HELP OPTIMIZE SAWLOGS

How?
- Increased Recovery
- Increased Value
- Reduced Degrade
CURVE SAWING IS NOT COMPLICATED

Scrag saw opposing sides

Curve saw cant

Lumber & pallet cants
CURVE SAWING EXAMPLES
OTHER CURVE SAWING RESULTS
Curve Sawing Conventional Saw Mill Logs - How many are curved?
### Sweep Summary of Study Logs at Eastern Hardwood Sawmills

#### Table

<table>
<thead>
<tr>
<th>Sweep Deduction</th>
<th># of logs</th>
<th>% of logs</th>
<th>Log Length (ft.)</th>
<th>Log Diameter (in.)</th>
<th>Sweep (in.) (12 ft. basis)</th>
<th>Sweep Deduction (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0% to 5%</td>
<td>1166</td>
<td>68.8%</td>
<td>12.5</td>
<td>14.8</td>
<td>0.7</td>
<td>0.5%</td>
</tr>
<tr>
<td>5% to 10%</td>
<td>216</td>
<td>12.8%</td>
<td>11.6</td>
<td>15.2</td>
<td>3.0</td>
<td>7.0%</td>
</tr>
<tr>
<td>10% to 15%</td>
<td>147</td>
<td>8.7%</td>
<td>11.6</td>
<td>14.5</td>
<td>3.9</td>
<td>12.3%</td>
</tr>
<tr>
<td>15% to 30%</td>
<td>136</td>
<td>8.0%</td>
<td>11.3</td>
<td>14.2</td>
<td>5.5</td>
<td>20.5%</td>
</tr>
<tr>
<td>&gt; 30%</td>
<td>29</td>
<td>1.7%</td>
<td>12.0</td>
<td>12.9</td>
<td>7.4</td>
<td>38.9%</td>
</tr>
<tr>
<td>Total</td>
<td>1694</td>
<td>100.0%</td>
<td>12.2</td>
<td>14.7</td>
<td>1.7</td>
<td>4.6%</td>
</tr>
</tbody>
</table>

Avg. = 13%

2/3 – considered straight
CANTS THRU CURVE SAW
OUTER BOARDS THRU CURVE SAW
CURVE SAW MOVING EXAMPLES
Curvesaw Edger Specs

- Cants feed 80-110 fpm
- Boards feed 500-700 fpm

- Arbor box - swivel +/- 4 degrees
- Max slew for cants and boards = 4” in 10’
- Handles sweep 1-3/4” in 10’
- Gang saws = 24.5 dia, 24t, plate .100, kerf .140
- Board saws = 24.5 dia, 78t, plate .120, kerf .160
<table>
<thead>
<tr>
<th>ID #</th>
<th>Decision</th>
<th>#Brd-Total</th>
<th>Value</th>
<th>Slew</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>4012</td>
<td>4/4x12.6-8' 3com</td>
<td>10-Brd</td>
<td>$29.58 -2.57</td>
<td>0.00 / 10</td>
<td>4</td>
</tr>
<tr>
<td>4013</td>
<td>4/4x11.3-8' 3com</td>
<td>9-Brd</td>
<td>$26.11 -2.26</td>
<td>0.00 / 10</td>
<td>4</td>
</tr>
<tr>
<td>4017</td>
<td>4/4x11.3-8' 3com</td>
<td>9-Brd</td>
<td>$26.22 -2.28</td>
<td>0.50 / 10</td>
<td>3</td>
</tr>
<tr>
<td>4018</td>
<td>4/4x10.1-8' 3com</td>
<td>8-Brd</td>
<td>$24.38 -2.12</td>
<td>0.00 / 10</td>
<td>4</td>
</tr>
<tr>
<td>4019</td>
<td>4/4x11.3-8' 3com</td>
<td>9-Brd</td>
<td>$26.11 -2.26</td>
<td>-0.80 / 10</td>
<td>3</td>
</tr>
<tr>
<td>4023</td>
<td>4/4x11.3-8' 3com</td>
<td>9-Brd</td>
<td>$28.52 -2.48</td>
<td>0.00 / 10</td>
<td>3</td>
</tr>
<tr>
<td>4024</td>
<td>4/4x10.1-10' 3com</td>
<td>8-Brd</td>
<td>$29.47 -2.49</td>
<td>-3.07 / 10</td>
<td>4</td>
</tr>
<tr>
<td>4032</td>
<td>4/4x10.1-8' 3com</td>
<td>8-Brd</td>
<td>$23.09 -2.01</td>
<td>0.00 / 10</td>
<td>4</td>
</tr>
<tr>
<td>4043</td>
<td>4/4x8.8-10' 3com</td>
<td>7-Brd</td>
<td>$28.21 -2.38</td>
<td>0.00 / 10</td>
<td>4</td>
</tr>
<tr>
<td>4051</td>
<td>4/4x10.1-10' 3com</td>
<td>8-Brd</td>
<td>$25.30 -2.00</td>
<td>0.00 / 10</td>
<td>4</td>
</tr>
<tr>
<td>4064</td>
<td>4/4x10.1-8' 3com</td>
<td>8-Brd</td>
<td>$28.98 -2.52</td>
<td>0.00 / 10</td>
<td>4</td>
</tr>
<tr>
<td>4068</td>
<td>4/4x11.3-8' 3com</td>
<td>9-Brd</td>
<td>$28.98 -2.52</td>
<td>0.00 / 10</td>
<td>4</td>
</tr>
<tr>
<td>4073</td>
<td>4/4x10.1-10' 3com</td>
<td>8-Brd</td>
<td>$32.24 -2.72</td>
<td>0.00 / 10</td>
<td>4</td>
</tr>
<tr>
<td>4618</td>
<td>4/4x8.8-12' 3com</td>
<td>7-Brd</td>
<td>$31.05 -2.70</td>
<td>0.00 / 10</td>
<td>6</td>
</tr>
<tr>
<td>4802</td>
<td>4/4x13.1-12' 3com</td>
<td>9-Brd</td>
<td>$41.86 -3.64</td>
<td>1.70 / 10</td>
<td>6</td>
</tr>
<tr>
<td>4838</td>
<td>4/4x13.1-12' 3com</td>
<td>9-Brd</td>
<td>$42.44 -3.68</td>
<td>1.70 / 10</td>
<td>6</td>
</tr>
<tr>
<td>4615</td>
<td>4/4x7.5-10' 3com</td>
<td>6-Brd</td>
<td>$23.60 -1.99</td>
<td>-1.51 / 10</td>
<td>3</td>
</tr>
<tr>
<td>4840</td>
<td>4/4x11.3-10' 3com</td>
<td>9-Brd</td>
<td>$35.69 -3.01</td>
<td>0.00 / 10</td>
<td>5</td>
</tr>
<tr>
<td>4841</td>
<td>4/4x10.1-14' 3com</td>
<td>8-Brd</td>
<td>$34.38 -2.52</td>
<td>0.00 / 10</td>
<td>9</td>
</tr>
</tbody>
</table>

**PLC:** NBE Optimized Gang/Edger Grade 2, Cherry

Start 11:25  Run 0:05  No Production 0:04

Scan speed: 513 fpm  Gap: 3.9 sec  Rate: 14 ppm

Scanner 1:1.62/1.87  2:2.24/2.19  Feedspeed: 111

Left Saw: 5.487  Entry/Exit Angles: 4.02 -1.77° / 10

Debug F109 P000 R18 M023 O10001

**Replay Frozen** Boards 33  1412 bdft

**Exposure:** 5/16 1.9 Zone 1-7128/7171

Width: 10.82  Height: 7.07
LESS THAN 3” SWEEP LOG CANTS
3” AND GREATER SWEEP
OUTPUT STRAIGHT SAWING THE CANTS
OUTPUT CURVE SAWING THE CANTS
RESULTS – notice curved pallet cant
**Lumber Value Per Board Foot of Log Input (Low-curve, Both Log Grades)**

<table>
<thead>
<tr>
<th>Run</th>
<th>Group</th>
<th>FAS</th>
<th>1C</th>
<th>2C</th>
<th>3C</th>
<th>Total</th>
<th>$ per bf</th>
</tr>
</thead>
<tbody>
<tr>
<td>643533</td>
<td>G2 Low - Curved</td>
<td>$798</td>
<td>$669</td>
<td>$219</td>
<td>$66</td>
<td>$1,752</td>
<td>$ 2.06</td>
</tr>
<tr>
<td>643534</td>
<td>G2 Low - Straight</td>
<td>$987</td>
<td>$1,006</td>
<td>$245</td>
<td>$88</td>
<td>$2,326</td>
<td>$ 1.88</td>
</tr>
<tr>
<td>643538</td>
<td>G3 Low - Curved</td>
<td>$216</td>
<td>$424</td>
<td>$212</td>
<td>$117</td>
<td>$969</td>
<td>$ 1.34</td>
</tr>
<tr>
<td>643537</td>
<td>G3 Low - Straight</td>
<td>$78</td>
<td>$445</td>
<td>$234</td>
<td>$76</td>
<td>$832</td>
<td>$ 1.23</td>
</tr>
</tbody>
</table>


**Appalachian Pricing ($/MBF)**

<table>
<thead>
<tr>
<th>$</th>
<th>2,100</th>
<th>1,205</th>
<th>580</th>
<th>375</th>
</tr>
</thead>
<tbody>
<tr>
<td>G2 Low - Curved</td>
<td>$2.06</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G2 Low - Straight</td>
<td>$1.88</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G3 Low - Curved</td>
<td>$1.34</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G3 Low - Straight</td>
<td>$1.23</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


$5,880
Yield Increase from Curve Sawing vs. Straight Sawing -- 8 foot logs

<table>
<thead>
<tr>
<th>Log Sweep (in)</th>
<th>Yield Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 2.0</td>
<td>2.8%</td>
</tr>
<tr>
<td>2.1 - 3.0</td>
<td>10.9%</td>
</tr>
<tr>
<td>3.1 - 4.0</td>
<td>12.9%</td>
</tr>
<tr>
<td>4.1 - 5.0</td>
<td>15.9%</td>
</tr>
<tr>
<td>5.1 - 7.0</td>
<td>19.5%</td>
</tr>
</tbody>
</table>
GREEN AND DRY LUMBER WARP? -- WE CHECKED
CURVE SAWING POTENTIAL LOOKS GREAT

- Yield and value increases
- Lumber and cants appeared to be no problems
- Drying results are similar
- Grain will be straighter
- Limitations on the amount of sweep that you can cut is specific to the curve sawing equipment
- Benefits are greater for small diameter logs
- Benefits are greater for longer logs
THIN KERF SAWING PROGRAM
-- ECHO

ECONOMIC CHOICE FOR HARDWOOD SAWMILL OPERATIONS

A program to determine the investment feasibility of installing reduced-kernel and higher-accuracy sawing machines in hardwood sawmills.

Copyright (c) Philip H. Steele, Craig Boden
Forest Products Laboratory
Mississippi State University
and
Philip A. Araman
Southern Research Station
U.S.D.A. Forest Service

April 2002, Version 3.13
Select an option:

< START A NEW ANALYSIS >
< LOAD A PREVIOUS ANALYSIS >
< RETURN TO CURRENT ANALYSIS >
< EXIT >
< HELP >
(●) Compute increased revenue from conversion improvement

( ) Enter your estimated increased revenue
Enter the new and/or current values for the variables given below.

<table>
<thead>
<tr>
<th>Current</th>
<th>New</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.28</td>
<td>0.165</td>
</tr>
</tbody>
</table>

1) Headrig kerf (0.10 - 0.35 inch): 0.28 0.165

2) Average log diameter (8 - 24 inches): 16

3) Average log length (8 - 18 feet): 12
ECHO - CHANGE RESAW KERF OPTION

Change resaw kerf? ( ) Yes (●) No

Previous Next Exit Help
ECHO - CHANGE ROUGH GREEN SIZE OPTION

( ) Change current rough green size for resaw only

(●) Change current rough green size for headrig only

( ) Change current rough green size for resaw and headrig

( ) Do not change current rough green size

Previous   Next   Exit   Help
<table>
<thead>
<tr>
<th>Thickness</th>
<th>Total Production (%)</th>
<th>Percentage Processed at the Headrig (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4/4</td>
<td>50</td>
<td>70</td>
</tr>
<tr>
<td>5/4</td>
<td>50</td>
<td>70</td>
</tr>
<tr>
<td>6/4</td>
<td>50</td>
<td>70</td>
</tr>
<tr>
<td>7/4</td>
<td>50</td>
<td>70</td>
</tr>
<tr>
<td>8/4</td>
<td>50</td>
<td>70</td>
</tr>
</tbody>
</table>
Enter the current and new rough green size values for each thickness of lumber that will be processed.

<table>
<thead>
<tr>
<th>Thickness</th>
<th>Current Rough Green Size (in.)</th>
<th>New Rough Green Size (in.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4/4</td>
<td>1.125 (0.75 - 1.25)</td>
<td>1.11 (0.75 - 1.25)</td>
</tr>
<tr>
<td>5/4</td>
<td>1.375 (1.00 - 1.50)</td>
<td>1.36 (1.00 - 1.50)</td>
</tr>
<tr>
<td>6/4</td>
<td>(1.20 - 1.75)</td>
<td>(1.20 - 1.75)</td>
</tr>
<tr>
<td>7/4</td>
<td>(1.50 - 2.00)</td>
<td>(1.50 - 2.00)</td>
</tr>
<tr>
<td>8/4</td>
<td>(1.75 - 2.25)</td>
<td>(1.75 - 2.25)</td>
</tr>
</tbody>
</table>
Enter the percentage of the average log volume produced as a center cant that is not subsequently processed at the resaw: 30
The changes which are given below will improve conversion efficiency by an estimated 4.59%.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Current</th>
<th>New</th>
</tr>
</thead>
<tbody>
<tr>
<td>Headrig kerf (in.)</td>
<td>0.28</td>
<td>0.165</td>
</tr>
<tr>
<td>Resaw kerf (in.)</td>
<td>---------</td>
<td>---------</td>
</tr>
<tr>
<td>Rough green size (in.)</td>
<td>4/4 = 1.125</td>
<td>4/4 = 1.11</td>
</tr>
<tr>
<td></td>
<td>5/4 = 1.375</td>
<td>5/4 = 1.36</td>
</tr>
<tr>
<td></td>
<td>6/4 =</td>
<td>6/4 =</td>
</tr>
<tr>
<td></td>
<td>7/4 =</td>
<td>7/4 =</td>
</tr>
<tr>
<td></td>
<td>8/4 =</td>
<td>8/4 =</td>
</tr>
</tbody>
</table>
SELECT THE OPTION TO WHICH THE INCREASED LUMBER PRODUCTION WILL BE APPLIED:

(*) INCREASED LUMBER PRODUCTION ONLY

(*) DECREASED LOG COST ONLY

(*) BOTH INCREASED LUMBER PRODUCTION AND DECREASED LOG COST
Current annual lumber production (MBF) -> 10000
Combined current revenue from 4/4 and 5/4 lumber sales ($/MBF) -> 555
Reduced overhead on increased production ($/MBF) -> 0
Current log cost ($/MBF) -> ----
Current annual log volume purchased (MBF) -> ----
ECHO - ESTIMATED INCREASED REVENUE RESULTS

Total revenue from lumber sales → $5,550,000

Conversion efficiency improvement → 4.59%

Estimated increased revenue from increased lumber production → $254,745

Estimated decreased cost as a result of log purchase reduction → $0

Net estimated increased revenue → $254,745

Use this value for estimated increased revenue? ( ) Yes   ( ) No

Previous   Next   Exit   Help
ECHO - CAPITAL COSTS

Initial sawing machine cost  --> $120000
Initial saw blade cost  --> $5000
Saw installation cost  --> $15000
Saw brake cost  --> $5000
Debarker cost  --> $35000

Previous  Next  Exit  Help
ECHO - CAPITAL COSTS

Filing room building cost----------------->$ 40000

Total additional filing room equipment cost ---------------------------------->$ 25000

Cost of additional buildings as a result of the investment (including construction costs for a pit to house the band headrig) --------->$ 30000

Additional equipment (other than filing room equipment) cost as a result of the investment ---------------------------------->$ 7000
For the two lines below, enter only the amount of the increase in annual wages.

Increase in annual filing room wages------>$ 39000

Increase in annual sawyer wages--------->$ 0
ECHO - VARIABLE COSTS

Annual saw blade replacement cost --> $5000

Annual grinding wheels and grinding room maintenance cost --> $2000

Annual cost to resurface wheels --> $1000

Other increased annual costs --> $0
ECHO - INVESTMENT RATES

Years

Corporate tax rate [%]

Alternative investment rate [%]

Property tax rate [%]

Insurance rate [%]

Method of depreciation
( • ) Straight-line method ( ) MACRS method

Previous  Next  Exit  Help
### ECHO - CASH FLOW ANALYSIS

#### RESULTS

<table>
<thead>
<tr>
<th>Year</th>
<th>Net Cash Flow</th>
<th>After-Tax Profit</th>
<th>After-Tax Cash Flow</th>
<th>After-Tax Present Worth</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>$ -282,000</td>
<td>$ 0</td>
<td>$ -282,000</td>
<td>$ -282,000</td>
</tr>
<tr>
<td>1</td>
<td>$ 202,825</td>
<td>$152,473</td>
<td>$ 129,527</td>
<td>$ 135,531</td>
</tr>
<tr>
<td>2</td>
<td>$ 202,825</td>
<td>$152,473</td>
<td>$ 22,945</td>
<td>$ 120,472</td>
</tr>
<tr>
<td>3</td>
<td>$ 202,825</td>
<td>$152,473</td>
<td>$ 175,418</td>
<td>$ 107,086</td>
</tr>
<tr>
<td>4</td>
<td>$ 202,825</td>
<td>$152,473</td>
<td>$ 327,890</td>
<td>$ 95,188</td>
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<tr>
<td>5</td>
<td>$ 202,825</td>
<td>$152,473</td>
<td>$ 480,363</td>
<td>$ 84,611</td>
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<tr>
<td>6</td>
<td>$ 202,825</td>
<td>$152,473</td>
<td>$ 632,835</td>
<td>$ 75,210</td>
</tr>
<tr>
<td>7</td>
<td>$ 202,825</td>
<td>$152,473</td>
<td>$ 785,308</td>
<td>$ 66,853</td>
</tr>
<tr>
<td>8</td>
<td>$ 202,825</td>
<td>$152,473</td>
<td>$ 937,781</td>
<td>$ 59,425</td>
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<tr>
<td>9</td>
<td>$ 202,825</td>
<td>$152,473</td>
<td>$1,090,253</td>
<td>$ 52,823</td>
</tr>
<tr>
<td>10</td>
<td>$ 202,825</td>
<td>$152,473</td>
<td>$1,242,726</td>
<td>$ 46,953</td>
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<tr>
<td>Total</td>
<td>$1,746,250</td>
<td></td>
<td>$1,242,726</td>
<td></td>
</tr>
</tbody>
</table>

**Previous**  **Next**  **Exit**  **Help**
<table>
<thead>
<tr>
<th>Analysis Summary</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial investment</td>
<td>$282,000</td>
</tr>
<tr>
<td>Payback period</td>
<td>1.85 years</td>
</tr>
<tr>
<td>Internal rate of return</td>
<td>53.3%</td>
</tr>
<tr>
<td>Present net worth</td>
<td>$562,154</td>
</tr>
</tbody>
</table>
PalleT CANT Quality and CANT Grades
WHAT WILL BE COVERED TODAY ...

- The history of wood related and recovery/recycling R&D in Blacksburg
- Ways to think about minimizing production waste
- Wood products that fit “Green Systems”
- Sawmill topics – edging and trimming, curve sawing, thin kerf sawing, pallet cants & parts
- Touch on pallets – PDS, heat treating, trends
- Secondary processing – rough mill types, ROMI programs, finger jointing
- Wood recovery – reuse – recycling opportunities?
  - Construction waste
  - Pallets
  - Used decking
STRINGER PALLETS
Block Pallets
PALLET DESIGN SYSTEM Version 4.1
Pallet Specification Sheet

Customer:
Company Name of Customer
Address of Customer

Prepared by:
Pallet Industrial and NMPCA Member
Licensed to Perform PDS Design Work
PDS License: 50 Printed: December 02, 2008

Pallet ID: Stringer-Class Pallet Example
Classification: 48 x 40, Stringer-Class, Double-Face Non-Reversible, Partial 4-Way, Multiple Use, New Lumber
Pallet Treatment: ISP-M15 Compliance; Heat Treatment (HT)

Components

Top Deck:

<table>
<thead>
<tr>
<th>Style Deckboard</th>
<th>Type</th>
<th>New Lumber</th>
<th>Number</th>
<th>Width</th>
<th>Height</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>0.625</td>
<td>3.000</td>
<td>40.00</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>0.625</td>
<td>5.000</td>
<td>40.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volume: 4.9 bd ft</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Bottom Deck:

<table>
<thead>
<tr>
<th>Style Deckboard</th>
<th>Type</th>
<th>New Lumber</th>
<th>Number</th>
<th>Width</th>
<th>Height</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>0.625</td>
<td>3.000</td>
<td>40.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>0.625</td>
<td>5.000</td>
<td>40.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volume: 3.7 bd ft</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Stringers:

<table>
<thead>
<tr>
<th>Type</th>
<th>New Lumber</th>
<th>Number</th>
<th>Width</th>
<th>Height</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>1.375</td>
<td>3.000</td>
<td>48.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volume: 4.9 bd ft</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Materials

Fasteners:

- Part No.: 2-1/4 x 1-1/2 Ga. 66
- Thread: Heavily Threaded Nail
- Thread Length: 1.25
- Thread Diameter: 0.124
- Head Diameter: 0.350
- Head: 7.5
- Finish: 4
- TiMed Angle: 60
- TiMed Angle: 36
- TiMed Angle: 36
- TiMed Angle: 36
- TiMed Angle: 67
- TiMed Angle: 84

New Lumber:

- Lumber B: Mixed Eastern Hardwoods

Spec Sheet Notes:

Information specific to Customer Internal.
The Pallet Design System® Version 5.0
3-D Design and Engineering Tool for Wood Pallets and Unit Loads

The industry's premier design tool for wood pallets has evolved into a design tool for unit loads.

The next version of PDS is the result of years of planning and development.

It will enable clear communication about the customer's unit load handling requirements and the pallet's ability to meet those requirements.

Wood pallet manufacturers produce the key component to successful unit load material handling – the pallet – the interface between the equipment, forces and impacts of the material handling environment and the Customer's valuable, sometimes fragile, unitized load.

And PDS is the key tool in designing this key component.

For more information, call 703.519.6104, email palletinfo@palletcentral.com, or visit www.palletcentral.com.
HEAT TREATMENT IN KILNS TO SANITIZE PALLETS FOR INTERNATIONAL SHIPMENTS
Phytosanitary Compliance

Due to the International Plant Protection Convention (abbreviated IPPC), most pallets shipped across national borders must be made of materials that are incapable of being a carrier of invasive species of insects and plant diseases. The standards for these pallets is specified in ISPM 15.

Pallets made of raw, untreated wood are not compliant with ISPM 15. To be compliant the pallets (or other wood packaging material) must meet debarked standards, and must be treated by either of the following means under the supervision of an approved agency:

- **Heat treatment** The wood must be heated to achieve a minimum core temperature of 56 °C (132.8 °F) for at least 30 minutes. Pallets treated via this method bear the initials HT near the IPPC logo.

- **Chemical fumigation** The wood must be fumigated with methyl bromide. Pallets treated via this method bear the initials MB near the IPPC logo. From 19 March 2010 the use of Methyl Bromide as an acceptable treatment according to ISPM15 has now been phased out.

Pallets made of non-wood materials such as steel, aluminum, plastic, or engineered wood products, such as plywood, oriented strand board, or corrugated fiberboard do not need IPPC approval, and are considered to be exempt from ISPM 15 regulations.
HEAT TREATMENT NEEDS ARE GROWING

- International Standards
- Domestic movement of invasive species causing further restrictions
  - Kentucky +
  - Emerald ash borer
  - Woodwasp
  - Pine shoot beetle
- Repeated treatments?
- Recent APHIS study
- Looking at the environmental benefits and costs of requiring all pallets to be treated
  - New and repaired (used)
- Updates at NWPCA website
New pallets compared to pallets recovered, repaired, rebuilt and sold to pallet users.
The history of wood related and recovery/recycling R&D in Blacksburg

Ways to think about minimizing production waste

Wood products that fit “Green Systems”

Sawmill topics – edging and trimming, curve sawing, thin kerf sawing, pallet cants & parts

Touch on pallets – PDS, heat treating, trends

Secondary processing – rough mill types, ROMI programs, finger jointing

Wood recovery – reuse – recycling opportunities?

- Construction waste
- Pallets
- Used decking
ROUGH MILL LAYOUT OPTIONS - FOR DIFFERENT PRODUCTS

- Rip first
- Crosscut first
- Combination rip and crosscut
RIP FIRST ROUGH MILL

lumber for ripping

Ripped strips

gang rip with floating blades or fixed or single blade

chop saws

finger joint shorts

parts
CROSSCUT FIRST ROUGH MILL

lumber for crosscutting

chop saws

pieces to edger ripping saw

rips on a cut-to-length board section

parts

parts

finger joint shorts

salvage crosscut
ROUGH MILL PROCESSING

- Crosscut first rough mill
  - Workers dictate yields of parts from lumber
  - There are no good rules to teach workers to maximize yield

- Rip first rough mills
  - Workers have easier decision to make
  - Mostly go / no go

- Yields can be similar -- difficulty makes the difference

- Scanning systems help – we can talk ...
Combination Rough Mill

- Crosscut or Rip first
- Sort lumber to proper system
- In general –
  - Narrow and higher grade to Crosscut first
  - Wider and lower grade to Rip first
- Can get complicated in controlling the production of needed cuttings
A computer tool to determine part yields and costs to produce needed parts in rough mills using different grades of lumber

- Crosscut first rough mill
- Rip first rough mill
- Goal – minimize costs

Rough-Mill Simulator ROMI 3 - Overview and New Features

- Timo Grueneberg, R. Edward Thomas, Urs K. Buehlmann
ROUGH-MILL SIMULATION - ROMI 3.0
ROugh-MIll Simulation – ROMI 3.0
SIMULATION SUMMARY (EXAMPLE)
LEAST COST GRADE MIX

<table>
<thead>
<tr>
<th>Grade</th>
<th>Price Per 1000 BDT</th>
<th>Processing Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>FAS</td>
<td>1600</td>
<td>200</td>
</tr>
<tr>
<td>SEL</td>
<td>1465</td>
<td>225</td>
</tr>
<tr>
<td>1C</td>
<td>1115</td>
<td>250</td>
</tr>
<tr>
<td>2A</td>
<td>920</td>
<td>286</td>
</tr>
<tr>
<td>3A</td>
<td>790</td>
<td>334</td>
</tr>
</tbody>
</table>

Least Cost Grade Mix Results

File

<table>
<thead>
<tr>
<th>%fas</th>
<th>%sel</th>
<th>%onec</th>
<th>%twoc</th>
<th>%threec</th>
<th>yield</th>
<th>cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>100</td>
<td>0</td>
<td>0</td>
<td>47</td>
<td>$13376.00</td>
</tr>
</tbody>
</table>

- Show results containing FAS
- Show results containing Selects
- Show results containing No. 1 Common
- Show results containing No. 2 Common
- Show results containing No. 3 Common

Print All Results  Save Results  Open Results  Close Window
ROMI 4.0 (Spring 2012)

- New user-interface
- Rip-and-Chop option
- Thickness option
ROMI Summary & Conclusion

- ROMI is a powerful tool to simulate real world sawmill operations
- ROMI was validated to increase rough mill yield
- ROMI provides a stable and flexible program to determine day-to-day rough-mill questions and simulation operations
  - what is the most cost-efficient grade mix for a cutting bill?
  - what is the optimal arbor spacing for this cutting bill?
  - how much lumber (of a given grade mix) will this cutting bill require?
- Built-in features include
  - an optimal arbor layout generator
  - a least cost grade mix calculator
  - rip-first-option, chop-first-option and rip-chop-first-option
  - “thickness”-option
Contact and Information:

Virginia Tech
Timo Grueneberg

tgruene2@gmail.com  (540.231.4674)

Urs Buehlmann
buehlmann@gmail.com  (540.231.9759)

Or me
Finger jointing improves yield and is called "green" by LEED and others.
What will be covered today ...

- The history of wood related and recovery/recycling R&D in Blacksburg
- Ways to think about minimizing production waste
- Wood products that fit “Green Systems”
- Sawmill topics – edging and trimming, curve sawing, thin kerf sawing, pallet cants & parts
- Touch on pallets – PDS, heat treating, trends
- Secondary processing – rough mill types, ROMI programs, finger jointing
- Wood recovery – reuse – recycling opportunities?
  - Construction waste
  - Pallets
  - Used decking
WOOD WASTE IS GENERATED IN HOME BUILDING – IT CAN AND SHOULD BE RECYCLED

From a little over a 2000 sq. ft. house

- Total wood waste – 5106 lbs.
- OSB Waste -- 1490 lbs.
  - Solid-Useable OSB – 598 lbs. (42%)
  - Grindable OSB – 892 lbs. (58%)
- Treated Wood Waste -- 417 lbs.
  - Solid-Useable Treated Lumber – 191 lbs. (46%)
  - Non-Useable Treated Lumber – 226 lbs. (54%)
- LVL – 64 lbs.
- Paralam – 25 lbs.
- Spruce Structural Lumber Waste – 3110 lbs.
  - Solid-Useable Spruce Structural Lumber – 244 lbs. (8%)
  - Grindable Spruce Structural Lumber – 2,866 lbs. (92%)

2,036 Sq. Ft.
Recycling Options - We can talk more if you are interested

<table>
<thead>
<tr>
<th>Potential OSB Products</th>
<th>Potential Spruce Products</th>
<th>Potential Ground Products</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shelving, Pallet Parts, Stair Treads and Risers</td>
<td>Finger-Jointed Structural Lumber and Molding</td>
<td>Mulch, Biofuels</td>
</tr>
<tr>
<td>OSB Subfloor</td>
<td>Spruce Structural Lumber</td>
<td>Spruce and OSB not Useable in Solid Products</td>
</tr>
<tr>
<td>Post-Construction OSB Waste Material</td>
<td>Post-Construction Spruce Structural Lumber Waste</td>
<td>On-Site Grinder</td>
</tr>
<tr>
<td>Board Products Made from Waste OSB</td>
<td>Finger-Jointed Structural Lumber</td>
<td>Wood Mulch</td>
</tr>
</tbody>
</table>
PALLET RECOVERY -- SEPARATION AREA AT LARGE RECYCLER
WHAT WE PUSH IN... URBAN WOOD PALLET RECOVERY, REUSE, AND RECYCLING

(SAVES TREES ..... SAVES LANDFILL SPACE ..... AND PROVIDES NEEDED WOOD PRODUCTS)

The Urban Resources

Shouldn’t Do

LANDFILLING

Questions - Contact Phil Araman
USDA Forest Service
Southern Research Station
Blacksburg, VA
(540) 231-5341  paraman@vt.edu

Repair
Pallet Disassembly
Mulch
Animal Bedding
Flooring/
Paneling
Fuel
REPAIRED PALLETS ARE IN DEMAND
New pallets compared to pallets recovered, repaired, rebuilt and sold to pallet users.
One of our pallet R&D efforts -- recycling used pallet parts to flooring for the “Green” market

- Recovered ½ inch pallet parts
- Multiple species
- Make 3/8 inch t&g flooring
- Helped a company produce
- Great for “Green” housing
- Picture is in a floral store in Asheville, NC
TREATED WOOD WASTE - A BUSINESS OPPORTUNITY?

New construction waste

Demolition waste
COMPARING TREATED WOOD WASTE FROM OUR RESEARCH

New homes - 5-500 lbs

Used decking - 1500-3300 lbs
**Used treated wood is easier to recycle**

More, bigger pieces, more reuse and recycling options

Less waste, smaller pieces, fewer recycling options
THE BOTTOM LINE IS -- PRODUCTS CAN BE MADE FROM USED RECYCLED DECK MATERIALS
WHAT WE COVERED TODAY ...

- Our history of wood related and recovery/recycling R&D
- Wood products that fit “Green Systems”
- Sawmill topics – edging and trimming, curve sawing, thin kerf sawing, pallet cants & parts
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- Wood recovery – reuse – recycling opportunities?
  - Construction waste
  - Pallets
  - Used decking
EarthCraft House, LEED for Homes, NAHB - Their guidelines will be code in the future.
You can join the movement or not, but the bottom line is you need to minimize production materials waste and reduce costs.