

Section III:

Saw Milling

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Process Overview

The purpose of saw milling is to produce lumber, cants, timbers, and other high value wood components from the log. In the processing of a 14-inch diameter log into these products at the typical Wisconsin sawmill, approximately 28 percent of the log is bark, 14 percent is converted to coarse residues (chips), 14 percent is converted to fine residues (sawdust), and 43 percent is solid wood--lumber, cants, and the like. Smaller logs produce more coarse residues and less lumber (10-inch log is 40 percent lumber; 6-inch log is 25 percent lumber); larger logs produce slightly more lumber and less coarse residues.

The residue sources from a debarked log in a typical Wisconsin sawmill are 7 to 18 percent sawdust, 11 percent edging strips, 3 percent edging errors, 11 percent end trim, 5 percent slabs, and 3 percent excessive lumber thickness.

The typical sawmill purchases logs at \$300 per thousand board feet (MBF) and sells the lumber produced at \$500 per MBF, with the residues having a value of 1/100 of lumber.

The typical functions of a Wisconsin sawmill are

- ! Unloading logs, predominantly 8- and 12-foot lengths
- ! Log scaling and grading
- ! Log storage (sometimes sprinkled with water)
- ! Transportation from the yard to the mill
- ! Debarking
- ! Head sawing
- ! Edging
- ! Resawing
- ! Trimming
- ! Grading and Sorting
- ! Stacking for transport

Potential Residue and Wastes: Solid and Hazardous

- ! wood (including defective pieces of lumber)
- ! bark
- ! energy
- ! oil and other petrochemicals from rolling stock and stationary equipment
- ! water from log yards
- ! air emissions from rolling stock

Waste Reduction Options/Case Studies/Checklists

There are four basic approaches to handling and controlling sawmill residues at mills today:

- ! Reduce the amount of waste generated.
- ! Convert the residue generated into a higher value product, so that it isn't considered a residue or waste product.
- ! Change processing so that the residues generated are higher in value.
- ! Dispose of residues in a reasonable manner.

(The options of letting the residues accumulate at the mill, land-filling with residues, or open burning are no longer viable in Wisconsin.)

Wood Products Value-Added Manufacturing and Finishing Manual

When a log is converted into lumber, there is a considerable volume of non-lumber products produced. Estimates for an 8-foot log (circular sawmill) are:

Log Dia	Lbr	Saw-dust	Slab/Edg ing	Lbr	Saw-dust	Slab/Edg ing	Lbr	Saw-dust	Slab/Edg ing
inch	-- cubic feet --			-- volume, % --			-- value, \$ --		
6	0.63	0.29	0.87	33	15	46	3.36	0.06	0.30
10	2.40	0.83	1.43	48	17	29	12.79	0.17	0.50
14	5.23	1.64	1.98	55	17	21	27.88	0.34	0.69
18	9.12	2.73	2.54	59	18	16	48.61	0.57	0.89

Notes: Totals do not include shrinkage of 5 percent. Prices are \$5.33/cu. Ft. for lumber; \$.35 for chips; and \$.21 for sawdust

These data indicate the value of larger logs from a volume recovery and efficiency standpoint and the extremely high value of lumber compared to residues.

Another way to look at the breakdown of a log is by volume per 1000 BF produced from small logs:

Item	Volume (ft ³)
Lumber	89
Non-Lumber Products	99
Sawdust (circular sawmill)	33
Edging and trimming	20
Bucking errors	20
Slabs	10
Edging and trimming errors	6
Overly thick lumber	6
Dry planing	4

Obviously anything done to reduce non-lumber items will increase the volume of lumber per log. Any decrease in residue will save money and time in disposal costs and a non-profitable part of the operation (that is, residue disposal is usually not profitable). The following offers waste residue tips in different areas of in the sawmill.

Log Yard

Logs with excessive sweep should be cut into shorter lengths, preferably in the woods.

Work with loggers to provide accurate log lengths. This can reduce residues by at least five percent, especially when used in conjunction with end coating.

End coat all logs promptly (March through October) to provide protection from stain and end checking, thereby reducing required end trimming. For logs stored over 12 weeks in the summer, end coating benefits include a reduction in end splitting and staining of over 20 inches per log.

When scaling and grading logs, mark a clear face by putting a spot of brilliant paint on the end. This will assist the sawyer in positioning the log, adding substantially to the volume of high grade lumber recovered and increasing value 15 percent or more.

Logs stored during the warmer months should be sprinkled with water to keep them "soaking wet" providing for higher quality logs.

Benefits

- ! reduced wood wastes
- ! improved yield

Cautions

- ! Careful attention to log storage is important to reduce unnecessary waste.

Sawing

When debarking a log, avoid taking any excess material from the log, especially the small end.

Use band rather than circle saws. Circle saws (9/32-inch kerf) produce much more sawdust than a band saw (3/32 inch and thinner). This is especially important to consider when new machinery is purchased. Sawdust volume is decreased by over 50 percent in some cases. Band resaws are preferred over circle resaws or bull edgers.

Keep the saw kerf in otherwise unusable wood--that is, in the slab or in the edging strip.

Consider laser indicators for the head saw, edger, and trimmer.

Open a log to either 4-1/2 inch wide faces for low grade faces and small logs (under 13-inches in diameter), and 6-1/2 inch wide faces for upper grade faces or logs over 13-inches in diameter. This will provide smaller slab waste, reducing waste by 4 percent or more. Headrig scanners provide accurate opening faces, reducing slab residues.

When rotating a log from the first face to the second face, rotate 180 degrees in order to provide better widths, less edging work, and straighter, more valuable lumber after drying.

Sawing Savings

Band Saws

Stellite band saws run at 0.140-inches; that will reduce sawdust volume by 56 percent or 18 cubic feet/MBF. The increase in lumber will be about 100 BF/MBF of lumber produced or roughly \$50,000/million BF produced.

Bucking Errors

These errors are very expensive. There are many techniques, both mechanical and electronic/laser, to measure distances accurately. If these errors could be reduced by half, a sawmill would recover 53 BF of lumber per 1000 BF, or about \$25,000/million BF produced.

Slabs

Until rectangular trees can be grown, slabs will always be present as a round log is squared up. Certainly, a substantial reduction in slab volume can be accomplished by sawing short lumber (4-foot long, minimum length) and by avoiding excessively wide opening faces. (Note: Maximum volume solutions do not correspond well with maximum value solutions--that is larger slabs may actually make more money.)

Consider resawing the slabs on a small, separate mill, producing short, clear pieces or parts.

Consider evaluating lumber thickness, attempting to avoid any unnecessary over-thickness. Some hardwood mills average 1-1/16 inch thickness for 4/4 lumber, while others are over 1-1/8 inch average. The difference is equivalent to about 5 percent more lumber from the same logs. Use linear positioners or computerized networks to obtain consistent lumber thicknesses. Mill maintenance and upkeep are important.

When handling logs, avoid removing any bark before the debarker in order to keep the logs as fresh and as high in quality as possible.

Use a computer on the headrig to assure that cants sent to the resaw are properly sized (and not over-sized).

Benefits

- ! reduced wood wastes
- ! improved yield

Cautions

- ! Careful attention to sawn lumber storage is important to reduce unnecessary waste.

Edging and Trimming

Edgers should be equipped with edging strip recovery systems so that large edging strips can possibly be remanufactured into small pieces of lumber or into parts. Trimmers should be able to recover 2-foot long or longer pieces.

Use proper edging procedures, including the 50/50 rule--that is, the amount of wood on the edging strip should equal the amount of wane on the lumber. The potential is about 20 percent more volume and over 25 percent more value from the edger.

Manufacture short length (2-feet minimum) lumber.

Consider manufacturing unedged lumber (pencil grading if necessary) and then letting the secondary manufacturer do the edging. The benefit is over 22 percent more high value parts from the same pieces of lumber.

Train edgemen using the computerized training tool from Virginia Tech.

Consider finger jointing small pieces cut from low grade lumber, slabs, and any large waste pieces. Increases in volume recovered will exceed three percent; value recovery will increase by 30 percent or more.

Storage

When tight piling or stacking lumber on the green chain, make sure that the lumber is protected from sun, rain, and excessive dust, so that quality is not lowered.

Lumber must be moved to the stacker within 24 hours during warm weather. Appropriate fungicides need to be used in warm weather when drying cannot be started within 24 hours. Highest grade lumber should be stacked within six hours for best quality in warm weather.

Edging Savings

Reduction Potential

The potential exists, if we could define a way to grade unedged and trimmed hardwood lumber, for a furniture or cabinet factory to achieve 23 percent more furniture parts from these flitches than from the same flitches if converted first to edged lumber. From 1000 BF of lumber they would achieve more than \$300 worth of additional parts; this “profit” could easily cover the added expense of drying unedged lumber (that is, loss of kiln capacity and handling problems). If we consider that the mill would get one third of the profits (\$100 per MBF of parts) and this would be applied to 25 percent of the production (that is, 25 percent of the pieces need edging), the income benefit would be about \$15,000/million BF of lumber produced.

Errors

Many mills over-edge their lumber. When optimizing the value from the edger, the volume of lumber produced at the edger will go up by 15 percent. This loss occurs because often the customer expects FAS edging on No. 1 and No. 2 Common lumber. And, often the edgerman is not familiar enough with the National Hardwood Lumber Association grading rules to produce an optimum value piece of lumber. If 25 percent of the lumber goes to the edger, then improved edging can increase lumber values by as much as \$19,000/million BF produced.

Overly Thick Lumber

Most customers are concerned about the thinnest pieces of lumber, not the thickest. The present average thickness of “inch and one eighth plus a little more” assures that the thinnest piece is at least 1-1/32-inch thick for most mills. But, in mills with linear positioners or other accurate networks, the potential exists to reduce average target size by several thirty-seconds of an inch and yet not produce thin lumber. The stumbling block is the consumer, but if an average reduction of 2/32-inch is possible on 4/4 lumber, the savings can be as high as 5 percent more lumber from the same logs or \$25,000/million BF produced.

Dry Planing

It isn't unusual to see 1/16-inch removed from lumber during the initial planing operation in a furniture or cabinet plant. However, with improved saws giving smoother surfaces, and with less variation between the thickest and thinnest pieces, perhaps there is potential to reduce planing allowances. (Conversely, much of our lumber today has more cup, so more planing allowance may be needed to “flatten” the board.) Perhaps the smoother surfaces would result in a reduction of average target size of 1/64-inch in the mill, or about 1-1/2 percent more lumber or \$7,500/million BF produced.

Checklist: Ideas for Increasing Sawmill Profitability Today

Log Yard

- Double check log grades to make sure you get what you pay for
- Calculate estimated values for each log; remove low grade logs
- Process logs by value classes
- Check log lengths to avoid overly long logs
- End coat logs to prevent stain, dry ends, and checks
- FIFO or LIFO for stain control

Debarking

- Check small end of logs for excessive wood loss

Sawing

- Check lumber thickness to show trouble spots
- Check lumber thickness to get the best thickness
- Check sawyer's procedures--patterns, opening face, rotation
- Check volume recovery
- Consider short length lumber
- Sawyer training classes for sawyer
- Grading classes for sawyer
- Send sawyer to visit major customers
- Know quality requirements for each customer
- Conduct group seminars on mill improvement

Edging and Trimming

- Check lumber for adequate wane. Check the number of pieces requiring remanufacturing (under-edged or under-trimmed) when grading--5 percent is probably optimum
- Negotiate edging reduction agreement with purchaser
- Edging and trimming seminars for mill employees
- Grading classes for edgermen and trimmermen
- Send edgermen and trimmermen to visit major customers
- Know quality requirements for each customer
- Group seminars on mill improvement

Grading

- Hire national inspector to spend a day in the mill
- Advanced lumber grading training for graders
- Send graders to visit major customers
- Group seminars on mill improvement

Marketing

- Visit major customers
- Compile quality list for each customer
- Explore opportunities for unedged lumber
- Explore opportunities for short length lumber
- Consider planing on the two wide faces; consider planing on the two edges and two faces

- ___ Consider adding a kiln (especially smaller capacity units)
- ___ Improve packaging

